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ORIGINAL ARTICLES.

1.—On the Evidence of the Transference of Secondary Sexual Characters of Mammals from Males to Females.

By C. I. Forsyth Major, M.D., F.Z.S.

WHEN Darwin stated in the first edition of the "Descent of Man," "as probable that horns of all kinds, even when they are equally developed in the two sexes, were *primarily* acquired by the male in order to conquer other males, and have been transferred more or less completely to the female,"[1] the "various facts" from which he drew this inference did not include any palæontological evidence. At the present day we are familiar with the notion that, as regards the deer family, the oldest members known, from the Oligocene, were absolutely devoid of antlers, and that the subsequent phylogenetic evolution of the latter has a close parallel in their ontogenetic development.

Except in the case of the reindeer, fossil Cervidæ cannot be expected to throw any direct light on our special subject of inquiry, since up to the present day the females of the great majority of Cervidæ are, as a rule, devoid of antlers. The generally received view is that amongst recent Cervidæ the females of the reindeer always have antlers, and the females of other deer never have.

According to a statement by Eversmann, quoted by A. Brandt,[2] the female wild reindeer in the Orenburg district are devoid of antlers. With regard to the Cervidæ generally, there is abundant testimony, to be found amongst older writers especially, of antlers occurring in females of *Capreolus* and *Cervus elaphus*.[3] Rütimeyer states that traces of pedicles are never absent in the doe;[4] and Nitsche confirms that this is in fact the rule in old individuals.[5]

[1] Charles Darwin: "The Descent of Man and Selection in relation to Sex," 1871, vol. ii, p. 248.

[2] Eversmann: "Naturgesch. v. Orenburg," ii, p. 251. Cf. A. Brandt in "Festschrift f. Rudolf Leuckart," 1892, p. 412.

[3] See the numerous bibliography, together with original observations, in A. W. Otto, "Lehrb. d. pathol. Anatomie d. Menschen und der Thiere," 1830, i, p. 167 and note 18.

[4] L. Rütimeyer: "Beiträge zu einer natürl. Geschichte der Hirsche," i: Abh. schweiz. palaeont. Ges., 1881, viii, p. 42.

[5] H. Nitsche: "Studien über Hirsche, 1898, i, pp. 23, 49, 50.

The phenomenon, however, is by no means restricted to senility. Otto himself dissected an antlered doe pregnant with two fœtuses,[1] and Nitsche shows that *the presence of antlers in the female Capreolus is independent of senile sterility.*[2]

Instances of the occurrence of antlers in the female Virginia and Columbia deer are adduced by Caton.[3]

If we survey the cases recorded in the literature, no doubt remains that the capacity of developing antlers is latent in the female Cervidæ, and only an impulse is required.

In a case recorded by W. Blasius, of a doe, the abnormal antler on the right side could be traced to a mechanical lesion produced by the presence of a piece of glass, and Blasius is probably right in supposing that the exostosis occasioned by the lesion assumed the shape of an antler, owing to its occurring in the region where the antlers are developed in the male.[4]

The remarkable case communicated to the Linnean Society by James Hoy on December 16th, 1791, is a curious parallel to the male plumage exhibited in female game-birds as a consequence of a lesion of the ovaries. "A hind, the female of *Cervus elaphus*, was shot by the Duke of Gordon, which had one horn perfectly similar to that of a stag three years old. It had never had a horn on the other side of its head, for there the corresponding place was covered over by the skin, and quite smooth. It did not seem to have ever produced a fawn, and upon dissection the ovarium *on the same side with the horn was found to be schirrous.*" [5]

Next in order comes the constant presence of rudimentary pedicles in old does, viz. at a time when the sexual functions have ceased.

Moreover, it appears, especially from Nitsche's observations alluded to above, that the females of *Capreolus*, at any rate, are beginning to develop antlers before senile sterility sets in; so that this new character of the doe has every chance of being transferred to her offspring, independent of the sex, and to become general in the does also, as it has become already almost general in female reindeers.

Giraffidæ.—For reasons formerly given,[6] I agree with Lydekker, by including in the family Giraffidæ the *Sivatherium* group of Ruminants from the Sivaliks (*Sivatherium—Brahmatherium—Hydaspitherium—Vishnutherium*).

The two recent species of *Giraffa* develop horns in both sexes.

Gaudry made known a hornless form, *Helladotherium Duvernoyi*, from the Upper Miocene of Pikermi; the skull described by him

[1] A. W. Otto: "Seltene Beobachtungen zur Anatomie, Physiologie, und Pathologie gehörig," 1816, i, p. 71 (xxx).

[2] Op. cit., p. 50, where is quoted also a former paper by the same author in Tharander forstliches Jahrbuch, 1883, xxii, p. 118.

[3] J. D. Caton: "The Antelope and Deer of America," 1881, 2nd ed., pp. 232, 233.

[4] Jahresber. d. Vereins f. Naturw. zu Braunschweig, ix, Sitzungsber., pp. 11–13 (1894–95).

[5] Trans. Linn. Soc., vol. ii, p. 356.

[6] Forsyth Major, "On the Fossil Remains of Species of the Family Giraffidæ": Proc. Zool. Soc. London, 1891, p. 315.

is the only one known of this genus, although various large-sized Giraffoid hornless skulls have in turn been called *Helladotherium*, and even united with the Pikermian species. For the present it cannot be decided whether the *Helladotherium* was hornless in both sexes or in the female only. The Giraffoid genus from the contemporary deposit of Samos—which occurs also at Maragha in Persia—has been founded by me on a form provided with supraorbital horns and on a hornless form, which otherwise agrees perfectly with the former; I therefore have considered them to be male and female forms respectively of one species, *Samotherium Boissieri*, Maj. A smaller, closely allied form, *Palæotragus Rouenii*, Gaudr. (Pikermi, Samos, Maragha), originally believed to be an antelope, is also represented by a form provided with, and one devoid of, horns.

"In the skull of an aged specimen of *Samotherium*, just above the orbits, where the large horns are placed in the horned specimens, there occur very small processes separated by a suture from the underlying part of the frontal."[1] The explanation I then submitted was, that in aged individuals of the female *Samotherium* male characters occasionally make their appearance. Another specimen,[2] of which but a portion of the frontal is preserved, exhibits above the *right* orbit only a similar epiphysis as the one just mentioned; its height is no more than 9 mm., with a longitudinal extension of about 32 mm. To judge from the size of the fragment and the texture of the bone, it belonged to an adult, although not an aged individual. It cannot therefore be considered to be a young specimen of the horned form; in the latter the horn attains a size of upwards of 210 mm.[3] Several other adult hornless skulls of *Samotherium*, one of which is in the British Museum, show no trace of an incipient horn.

From the foregoing we may conclude that in this Tertiary member of the Giraffidæ the females are beginning to develop horns, which primarily were male sexual characters of the *Samotherium*, whether used as weapons or purely ornamental.

Bovinæ.—With regard to all their salient characters the Bovinæ are the most terminal group of Ruminants. No instance of the occurrence of hornless females in recent *wild* bovine animals is known.

When working in the Palæontological Museum at Florence I came upon the hornless skull of a Ruminant from the Pliocene of the Val d'Arno, which had been discovered a few years previously and variously interpreted; the statement published somewhere that in the Val d'Arno fauna occurred a Ruminant closely allied to the camel, refers to the skull in question. On close examination I found that the fossil presented all the cranial and dental characters of Falconer's *Bos etruscus* from the same deposits, with the essential difference that no traces of horn-cores were present. My conclusion was that the skull was that of a female '*Bos etruscus*.' I published

[1] Forsyth Major, op. cit., p. 319.

[2] Nos. 712, 712*a* of my first collection from Samos, which is the property of Mr. William Barbey in Geneva.

[3] No. 17 of the Swiss Collection.

the fact at the time,[1] and also ventured to transmit the information to Charles Darwin, who embodied it in the second edition of his "Descent of Man."[2]

Unaware of my previous statement, Rütimeyer announced in 1878 as a novel fact the discovery of a hornless fossil member of the Bovinæ.[3] The skull in question, B.M. No. 48,037, from the older Pliocene of the Sivalik Hills, he described and figured as *Leptobos Falconeri*, Rüt. From the absence of horn-cores, from the great extension of the parietal zone, and from its general slender and elegant build, the skull is considered to be that of a female. But at the same time it is conjectured that part of the horned skulls attributed to the same species might equally be of the female sex; this on account of their weaker horns.[4]

The skull from the Val d'Arno is described and figured in the same memoir, together with the cast of a second equally hornless skull from the same locality, the original of which is preserved in the private collection of the Marchese Strozzi. Rütimeyer's conclusion is very different from mine; the hornless skulls from the Val d'Arno are named *Leptobos Strozzii*, and thus placed in a different genus and group from Falconer's *Bos etruscus*, which becomes the *Bibos etruscus*.[5] As Rütimeyer was indisputably the highest authority in this particular branch of palæontology, my previous most positive statement must have been considered in the light of a rather rash proceeding.

Years afterwards my excavations at Olivola (Upper Pliocene) brought to light several hornless bovine skulls, and made it incumbent on me to reinvestigate the whole matter, the more so as some additional horned skulls from the Val d'Arno had in the meantime enriched the Florence Museum. The result arrived at[6] was a confirmation of my former view, that the hornless and horned bovine skulls from the Upper Pliocene of Italy are one and the same species. This species is nearly related to the Sivalik *Leptobos*, as Rütimeyer had already shown with respect to the hornless form of the Val d'Arno. The obvious conclusion was to collocate the bovines from the Italian Pliocene in the genus *Leptobos: Leptobos elatus* (Croiz.).[7]

Stehlin, another pupil of Rütimeyer, has quite recently studied the Florentine collections; with regard to the above question, he declares that after repeated examination of the materials he agrees with my view that Rütimeyer's '*Leptobos Strozzii*' is nothing else than the female form of his '*Bibos etruscus*.'[8]

I do not think it necessary to enter into the particulars of the case, which are published. For the present purpose it is sufficient

[1] Palæontographica, 1873, II, 2 (xxii), p. 123. [2] 1874, p. 505.
[3] L. Rütimeyer, "Die Rinder der Tertiaer-Epoche," etc.: Abh. schweiz. palaeont. Ges., 1878, p. 162.
[4] Op. cit., p. 164. [5] Op. cit., pp. 167–175.
[6] Forsyth Major, "L'Ossario di Olivola in Val di Magra": Proc. Verb. Soc. Tosc. Sc. Nat., March 3, 1890, pp. 71–75.
[7] Forsyth Major, op. cit., p. 75.
[8] Abh. schweiz. palaeont. Ges., 1900, xxvii, p. 466, note.

to point out that in the earliest known—Pliocene—representatives of bovine animals, part, at any rate, of the females were devoid of horns, whereas, as stated before, the females of all the wild recent species, without exception, have acquired them. The occurrence of hornless forms in domestic races has been explained by Rütimeyer as a reversion.[1]

Suidæ.—The male weapons of Suidæ are the tusks. Stehlin has recently shown that the male *Potamochœrus provincialis* (Gerv.) from the Lower Pliocene of Montpellier was already provided with equally strong developed canines as the recent species. In the female fossil form they are about equally developed as in *Sus scrofa.*[2] Some years ago I figured on two plates male and female skulls of recent species of *Potamochœrus,*[3] from which it can be seen that in the Malagasy and East African *Potamochœri* the canines of the females are almost equal in size and shape to those of the males. The same occurs in the case of the Bornean *Sus barbatus,*[4] and, to judge from a skull described and figured by Rolleston,[5] may occur also in the female of *Sus andamanensis.*

In the West African *Potamochœrus,* according to Stehlin's observation, the canines of the female are weaker than in the eastern species.[6]

Stehlin has strongly insisted upon the importance of this instance of transmission of male sexual characters to the female, in *Potamochœrus.* "Dieselbe ist in doppelter Hinsicht von allergröstem Interesse. Einmal darum weil durch sie im allerletzten Abschnitt der Erdgeschichte nochmals ein evidenter Fortschritt gegenüber dem Pliocaen erzielt wird, sodann aber auch in rein morphologischer Hinsicht, insofern als mit ihrem Eintreten ein völlig neuer, bis dahin unbetretener Weg in der Umformung und Weiterbildung der ganzen Species betreten wird."[7] ("It is of the greatest interest, firstly, because by means of this transmission there is again an evident progress in the last chapter of the earth's history, as compared with the Pliocene; secondly, from a purely morphological point of view, because by it a hitherto completely new and untrodden road in the transformation and progression of the whole species is now opened.")

In our own species the modern aspirations of women are, to all appearances, the incipient signs of the same natural law. Physical and mental characters of man, originally acquired in the struggles of the males, are apparently being slowly transferred to women. They only require time for their full evolution.

[1] Op. cit., p. 173.
[2] H. G. Stehlin, "Über die Geschichte d. Suiden-Gebisses": Abh. schweiz. palaeont. Ges., 1899, xxvi, pp. 256, 257.
[3] Proc. Zool. Soc. London, 1897, pls. xxv, xxvi.
[4] Stehlin: op. cit., xxvii, p. 466.
[5] Trans. Linn. Soc. London, 1876, p. 286, pl. xli, fig. 3.
[6] l.c., xxvi, pp. 255, 256.
[7] Abh. schweiz. palaeont. Ges., 1900, xxvii, p. 466.

II. — Woodwardian Museum Notes: Salter's Undescribed Species. IV.

By F. R. Cowper Reed, M.A., F.G.S.

(PLATE XI.)

GASTEROPODA (*continued*).

Horiostoma discors (Sowerby), var. Mariæ (Salter MS.). (Pl. XI, Figs. 5 and 6.)

1873. *Euomphalus Mariæ*, Salter: Cat. Camb. Sil. Foss. Woodw. Mus., p. 156 (*a* 859, *a* 860).

1891. *Euomphalus Mariæ*, Woods: Cat. Type Foss. Woodw. Mus., p. 103.

There are four specimens of this form in the Woodwardian Museum, labelled *a* 859 and *a* 860 by Salter, and all come from the Wenlock Limestone of Dudley. Salter (*loc. cit. supra*) says of it: "Related to *E. discors*, but with most regular ridges of growth. A beautiful shell, dedicated to a most worthy lady—the patient preparer of this collection [Mrs. Fletcher]." All four specimens belong to the Fletcher Collection.

Diagnosis.—Shell nearly discoidal; spire short, usually low and depressed; whorls rounded, five or six in number, ornamented on their apical surface by four or five weak and inconspicuous longitudinal keels, which are crossed nearly at right angles by prominent transverse, equidistant, and regular sharp lamellæ, not very closely set together, and only very slightly undulated where they cross the weak keels. As they pass round to the umbilical surface of the whorls they bend back gently, but again curve forward to the line of contact of the whorls. The umbilical surface of the whorls is devoid of longitudinal keels, except in young individuals. Umbilicus deep, wide, open, exposing all the whorls. Aperture not preserved.

Measurements.

	mm.
Breadth of one specimen (*a* 859)	50·0
Approximate height of the same	20·0
Average distance of varices on upper surface	1·5
Breadth of specimen (*a* 860) showing the under surface of shell	64·0
Depth of umbilicus of same...	12·0

Remarks. — The distinguishing feature of this form is the regularity and prominence of the transverse lamellæ and their slight undulation in crossing the keels. Otherwise it closely resembles *H. discors* and its varieties, including *H. rugosum*, Sowerby.[1] It does not seem possible to retain it as an independent species, as it nearly approximates many specimens of this very variable species *H. discors*, and transitional forms with intermediate characters are not uncommon.

Horiostoma discors (Sowerby).

1873. *Euomphalus pacificatus*, Salter: Cat. Camb. Sil. Foss. Woodw. Mus., p. 156 (*a* 861).

1891. *Euomphalus pacificatus*, Woods: Cat. Type Foss. Woodw. Mus., p. 103.

[1] Lindström: Silur. Gastrop. Pterop. Kongl. Sv. Vet. Akad. Handl., Bd. 19, No. 6 (1884), pp. 157–159, pl. xvi, figs. 20–26; pl. xvii, figs. 1–10.

There is only one specimen of this form in the Museum thus labelled by Salter (*a* 861), and it comes from the Wenlock Limestone of Dudley.

Diagnosis.—Shell discoid; spire short; whorls six? (only three are preserved), angulated slightly by longitudinal keel near margin of flattened apical surface; sides of whorls ornamented by two weaker, equidistant, longitudinal keels. No keels on umbilical surface. Surface of whorls crossed by small, closely-set, transverse growth-lamellæ, slightly undulated and irregular, and curving backwards from the mouth outside the inner longitudinal keel of apical surface. Umbilicus not seen. Aperture apparently oblique. Breadth 36 mm.

Remarks.—There is no feature by which this form can be separated from the variable *H. discors*, and the species therefore must be dropped. The indentation on the outer whorl of the specimen is manifestly due to an injury to the shell, and cannot be considered as a character of any specific importance. It is not even desirable to separate this form as a definite variety of *H. discors*, a conclusion I have reached after examining a large series of the latter species.

Pleurotomaria Fletcheri, Salter. (Pl. XI, Fig. 4.)

1873. *Pleurotomaria Fletcheri*, Salter: Cat. Camb. Sil. Foss. Woodw. Mus., p. 154 (*a* 851).

1891. *Pleurotomaria Fletcheri*, Woods: Cat. Type Foss. Woodw. Mus., p. 112.

There is only the one original specimen (*a* 851) in the Woodwardian Museum from the Wenlock Limestone of Dudley and belonging to the Fletcher Collection. It is not quite perfect and is slightly compressed laterally, but the shell is preserved on the five whorls. The figure of a *Pleurotomaria* given by Salter (*op. cit. supra*, p. 154) in the margin closely resembles this species.

Diagnosis.—Shell broadly conical; apical angle 50°–60°; whorls six in number (only five are preserved), convex, with slit-band grooving middle of body-whorl, but situated below middle line of other whorls though above suture-line. Two weak longitudinal keels, of which the lower is the stronger, are present on apical surface of body-whorl above slit-band at equal distances between it and suture-line. On the upper whorls the keel nearer the slit-band is more prominent and slightly angulates the apical surface of the whorl, but the other keel nearer the suture-line is almost obsolete. Slit-band concave and sunken as a groove between sharp, prominent, narrow borders; crescents fine, closely packed, sharply curved. Ornamentation of apical surface consists of obliquely transverse, slightly sigmoidal striæ, and wrinkles bending back sharply near the slit-band to meet it as an acute angle. The ornamentation below the slit-band is similar, the striæ being sharply curved back to meet it. Aperture not preserved. Height of specimen *ca.* 45 mm.

Remarks.—The broadly conical shape of the shell and the position of the slit-band on the whorls, as well as its groove-like nature, are features found also in *Pl. biformis* (Lindström),[1] but the ornamentation of the surface is quite distinct, and only one keel is figured in that species above the slit-band.

[1] Lindström: op. cit., p. 98, pl. vii, figs. 39–42.

PLEUROTOMARIA CYCLONEMA (Salter). (Pl. XI, Figs. 1–3.)

1873. *Murchisonia cyclonema*, Salter: Cat. Camb. Sil. Foss. Woodw. Mus., p. 155 (*a* 848, *a* 849, *a* 850).
1891. *Murchisonia cyclonema*, Woods: Cat. Type Foss. Woodw. Mus., p. 107.

There are in all fourteen specimens labelled *Murchisonia cyclonema* by Salter, varying in size from 10 mm. to 36 mm. in length. Several are in an excellent state of preservation, and all come from the Wenlock Limestone of Dudley and belong to the Fletcher Collection.

DIAGNOSIS. — Shell conical, turbinate; whorls five, ventricose. Apical angle 50°–60°, being smaller in the older and larger individuals. Body-whorl large, equal to half the length of shell or even more. Slit-band a little above middle line of body-whorl, but in other whorls half-way between the suture-lines. Apical surface with distinct swollen band immediately below upper suture-line of each whorl, and with one rounded, prominent, longitudinal keel between this band and the slit-band. Six or seven longitudinal keels below slit-band on body-whorl, of which the uppermost three or four are prominent rounded ridges, usually nearly equal in size, and nearly equidistant. The other three or four longitudinal keels on the body-whorl are on the umbilical surface, and grow successively much narrower, fainter, and less prominent. On the upper whorls the uppermost three longitudinal keels are alone developed in the adult, the number varying from one to three according to age. Slit-band prominent, of moderate width, bordered on each side by narrow ridge. Surface concave, but marked along centre by longitudinal keel, varying in degree of development, but making profile of slit-band very characteristic. Crescents not very numerous, gently arched backwards, but strongly marked, and in some of the smaller individuals sub-lamellar. Apical surface of whorls crossed obliquely by fine sigmoidal thread-like raised lines, at regular distances apart in young individuals but more closely and less regularly packed in adults. Below slit-band the whorls are ornamented by similar transverse lines, but crossing the keels nearly at right angles instead of obliquely. On both sides of the slit-band the lines are sharply bent back.

Mouth large, subcircular or oval, slightly oblique to axis of shell.

MEASUREMENTS.

	I	II	III
	mm.	mm.	mm.
Length	36·0	21·0	17·0
Breadth (across body-whorl) ...	25·0	15·0	13·5
Apical angle	50°	55°	60°

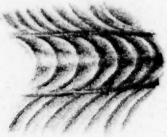
REMARKS.—This species bears much resemblance to *Pleurotomaria laqueata* (Lindström),[1] from the corresponding beds of Gotland, in its general shape, in the distribution and number of the keels, and in the position of the slit-band, but differs in the minute characters of the latter, which is an important point.

It has the general aspect of *Pl. Lloydi*, Sow., but differs in having only one keel above the slit-band and fewer and larger keels

[1] Lindström: op. cit., p. 102, pl. ix, figs. 4–6.

2

1



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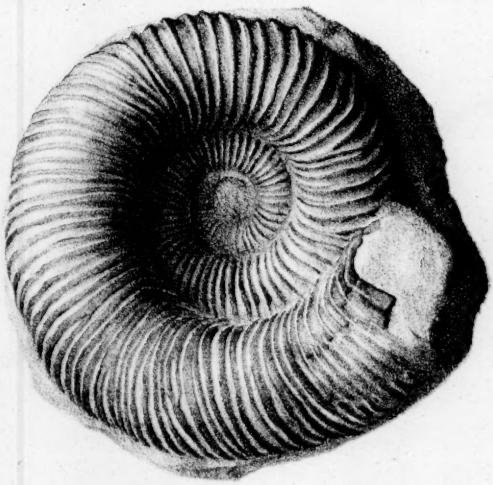

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4

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Gasteropoda, Wenlock Limestone, Dudley

below, and in the lower position of the slit-band and its minute characters. The slit-band, in fact, resembles more closely that of *Pl. bicincta* (Hall) [1] than that of any other species in the presence of the keel along the middle of the band and its sharp borders.

EXPLANATION OF PLATE XI.

FIG. 1.—*Pleurotomaria cyclonema*, Salter, sp. Nat. size.
FIG. 2.—Ditto, showing mouth. Nat. size.
FIG. 3.—Ditto, slit-band. × 5.
FIG. 4.—*Pleurotomaria Fletcheri*, Salter. Nat. size.
FIG. 5.—*Horiostoma discors*, var. *Mariæ*, Salter, sp. Nat. size.
FIG. 6.—Ditto, umbilical surface. Nat. size.

III.—Some Sections in the Cretaceous Rocks around Glynde, and their Fossil Contents.

By J. P. Johnson.

IN the memoir recently published by the Geological Survey [2] on the Selbornian strata of England, no mention is made of an interesting section in the Gault near Glynde, which was certainly in existence up to 1898, when I last visited the district. The object of the present note is to put this section on record, together with some observations on two chalk quarries, from which I have at various times collected fossils.

The pit in the Gault is situated on private land about a quarter of a mile from the railway station, with which it is connected by a railroad. As far as I can remember, it showed some 15 feet of slate-blue clay, containing an abundance of pyrites, and consequently a quantity of selenite, though in small crystals. The only organic remains that were at all plentiful were the ammonites, *Schlœnbachia varicosus*, *Hoplites denarius*, and *Ancyloceras spinigerum*. The finding of a big tooth of *Protosphyræna ferox* is noteworthy.

The large quarry in the Chalk at the railway station exhibits a fine section of the well-known limestone, which here contains a very small proportion of clayey matter and occasional nodules of marcasite. It is of Cenomanian age, as shown by the occurrence of *Schlœnbachia varians*. The commonest fossils are the Selachian remains, amongst which I may especially mention a nice series of the teeth of *Scaphanorhynchus subulatus* and forty-seven associated teeth of *Ptychodus decurrens*. It was from here that I obtained the fine mandibular ramus of *Pachyrhizodus Gardneri* which is in the British Museum.

Just outside the village, on the right-hand side of the road to Lewes, and joined to the above-mentioned quarry by a railroad, is another large excavation in the Chalk. This is at a higher level, and is in the face of the escarpment. The Chalk differs from that already described in being free from argillaceous matter; it also yields nodules of marcasite and, in the topmost beds, a few flints. It is mostly of Turonian age, as shown by the abundance of *Rhynchonella Cuvieri*, *Inoceramus mytiloides*, *I. Cuvieri*, and *Lima*

[1] Lindström: op. cit., p. 106, pl. viii, figs. 21 and 23.
[2] "The Cretaceous Rocks of Britain," vol. i (1900); by A. J. Jukes-Browne.

spinosa, but a little is probably Senonian, for the hard sub-crystalline band known as the Chalk Rock, which in this country stratigraphically separates the two periods, is certainly present, though I have not been able to determine its exact position, as the section has always been obscured during my visits by the talus resulting from blasting operations. I have a series of thirty-nine associated teeth of *Ptychodus mammilaris* from here in Chalk Rock matrix.

LIST OF FOSSILS.

	S.	C.	T.
PISCES.			
Pachyrhizodus Gardneri, Mason		*	
Cimolichthys Levesiensis, Leidy		*	
Protosphyræna ferox, Leidy	*	*	
(*Scaphanorhynchus?*) *subulatus*, Ag.		*	
Lamna appendiculata, Ag.		*	*
'*Oxyrhina angustidens*, Reuss'		*	
Oxyrhina Mantelli, Ag.		*	*
Corax falcatus, Ag.		*	*
Notidanus microdon, Ag.		*	
Ptychodus mammilaris, Ag.			*
Ptychodus decurrens, Ag.		*	
CEPHALOPODA.			
Nautilus (*sublævigatus*, D'Orb. ?)		*	
Ancyloceras spinigerum, J. Sby.	*		
Scaphites Hugardianus, J. Sby.	*		
Acanthoceras navicularis, Mant.		*	
Hoplites denarius, J. Sby.	*		
Schlœnbachia varians, J. Sby.		*	
Schlœnbachia varicosus, J. Sby.	*		
Desmoceras Beudanti, Brong.	*		
GASTROPODA.			
Aporrhais Parkinsoni, Mant.	*		
Pleurotomaria perspectiva, Mant.		*	
PELECYPODA.			
Nucula pectinata, J. Sby.	*		
Pholadomya decussata, Mant.		*	
(*Lima?*) *spinosa*, J. Sby.			*
Plagiostoma globosa, J. Sby.		*	
Inoceramus Cuvieri, J. Sby.			*
Inoceramus mytiloides, Mant.			*
BRACHIOPODA.			
Terebratula biplicata, J. Sby.		*	*
Rhynchonella Cuvieri, D'Orb.			*
CRUSTACEA.			
Enoploclytia Sussexiensis		*	
ECHINOIDEA.			
Peltastes clathratus, Ag.		*	

Skirting the Chalk escarpment westwards, one at length arrives at the classical Lewes quarries. They do not need to be dealt with

here, as they have already been described, but I think it desirable to mention three quartz pebbles which I obtained from one of the workmen. They were all in pieces of chalk, and one is encrusted with a species of Bryozoa. From the finder's description I gathered that they had either come from the highest of the Turonian beds or from the oldest of the Senonian.

Annexed is a list of the organic remains which I have collected from the above-described sections. The nomenclature of the Selachians is that employed by Dr. A. S. Woodward in his "Notes on the Shark's Teeth from British Cretaceous Formations."[1] With regard to the teeth termed '*Oxyrhina angustidens*,' they are of two kinds—those in which the back portion is smooth and those in which it is striated. I venture to think that these should be referred respectively to *Scaphanorhynchus subulatus* and *S. rhaphiodon*. Like the Selachians, *Protosphyræna ferox* is represented by teeth only, while *Cimolichthys Levesiensis* is indicated by a single example of its peculiarly barbed pterygoid teeth.

IV.—Note on a Chalk Ammonite, probably referable to *Ammonites Ramsayanus*, Sharpe.

By G. C. Crick, F.G.S., of the British Museum (Natural History).

In 1856 Sharpe[2] founded the species *Ammonites Ramsayanus* upon a single deformed specimen (in the collection of J. Wiest, Esq.) that was obtained from the "Chalk with silicious grains, at Chardstock, Somersetshire."

His description is as follows:—

"A testâ discoideâ, costatâ, tuberculatâ; anfractibus paucis, subcompressis: costis continuis, bi-tuberculatis, ad dorsum bifurcatibus: dorso lato, rotundato, costato, utrinque tuberculato: umbilico parvo: aperturâ oblongâ.

"Shell discoidal, with few, slightly flattened whorls, and a broad rounded back: the whorls are ornamented on the sides by twenty ribs, each of which rise from a small tubercle at the edge of the umbilicus, and has another larger tubercle near the back; at the latter tubercle each rib divides into two smaller ribs, which continue across the back, and unite again at the corresponding tubercle on the other side of the back: umbilicus small, allowing nearly half of the inner whorls to be seen: aperture oblong: the septa have not been seen."

Respecting the type-specimen Sharpe wrote:—"The only specimen which has been seen of this species is deformed, owing, without doubt, to an accident met with when very young. In consequence of this malformation, the two sides have very little resemblance to each other; and the specific character given above may prove incorrect when more perfect specimens are met with."

Mr. Jukes-Browne has recently called my attention to an Ammonite[3]

[1] Proc. Geol. Assoc., vol. xiii (1894).

[2] D. Sharpe: Foss. Moll. Chalk (Mon. Pal. Soc.), pt. iii, 1856, p. 51, pl. xxiii, ff. 4*a–c*.

[3] For the loan of this fossil my best thanks are due to the Rev. H. H. Winwood, M.A., F.G.S.

belonging to the Bath Museum that I think is referable to Sharpe's 'species.' The specimen is labelled "Chalk marl: Evershot." The dimensions of the type-specimen as given by Sharpe are:—Diameter, 1½ inch [or about 38 mm.]; height of the last whorl, ⅝ inch [or about 16 mm.]; width of the aperture, ½ inch [or about 12·75 mm.]. On account of the malformation of the specimen the width of the umbilicus is not quite the same on the two sides, but according to Sharpe's figures, which from their other measurements appear to be drawn of the natural size, the width of the umbilicus on the side represented in his fig. 4*a* is 11 mm. These dimensions expressed in terms of the diameter, when this is taken as 100, are:—Diameter, 100; height of last whorl, 41·66; width of the aperture (or thickness of the last whorl), 33·33; width of umbilicus, 30.

The dimensions of the present specimen, of which rather more than half the outer whorl belonged to the body-chamber, are:—Diameter, 35·5 mm. (100); height of the outer whorl, 14 mm. (39·43); thickness of the outer whorl (or width of the aperture), 13·5 mm. (38·0); width of umbilicus, 11 mm. (32·27). The specimen is well preserved and very nearly symmetrical, each side closely resembling the lateral view depicted by Sharpe in his fig. 4*a*, and the transverse section of the whorl agreeing very closely with his fig. 4*c*.

Compared with Sharpe's type-specimen, however, the present example exhibits some differences. It has a slightly wider umbilicus; the ribs on the lateral area are more distinct and regular even up to the anterior end of the specimen, but less numerous, being only sixteen in number on the outer whorl, and, in passing from the umbilicus towards the periphery, are more forwardly inclined, whilst the lateral tubercle is nearer the middle of the lateral area. The greatest difference, however, is in the character of the periphery. The whole of the periphery of Sharpe's type-specimen is broadly rounded from side to side. This is not quite the case in the present specimen. The periphery of the earliest portion of the outer whorl is on the whole broadly rounded but not regularly convex; one side is convex, but the other is somewhat flattened and in part depressed, so that the periphery of this portion of the outer whorl bears a feeble groove which is not quite in the median line. At a subsequent stage, i.e. at a short distance from the commencement of the outer whorl, two broad shallow grooves, about 3·5 mm. apart, appear (one a little earlier than the other) one on each side of the median line, and almost close to the margin, of the periphery; these gradually deepen as the whorl increases in size, and at the anterior end of the specimen are about 5 mm. apart.

The ribs on the two sides are not opposite but alternate; each bears a rather small compressed transversely-elongated tubercle at the umbilical margin, and a similar but more prominent tubercle at about the middle, or rather outside the middle, of the lateral area. On about the first half of the outer whorl each rib bifurcates, though not very distinctly, at the lateral tubercle, and the broad feeble branches cross the periphery, sometimes a little irregularly,

and join the branches from the opposite side, each branch being slightly thickened into an obtuse tubercle at the margin of the periphery. On the rest of the outer whorl each rib, instead of actually bifurcating, bends slightly backward at the lateral tubercle and passes straight to the peripheral margin, where it is slightly thickened into a blunt obtuse tubercle; whilst in the space between each pair of lateral tubercles, but somewhat nearer the periphery than the tubercles themselves, an obscure rib arises and also passes to the peripheral margin, where it is also similarly thickened; the tubercles on the intermediate ribs are frequently stronger than those at the extremities of the principal ribs. In a few instances the ribs are raised into a very obtuse tubercle on the median line of the periphery. On the peripheral area of the earliest portion of the outer whorl, i.e. the portion bearing the single feeble groove, the ribs on one side of the median line are slightly inclined backwards, whilst on the other side they are nearly direct. Although portions of the septa can be seen, a complete suture-line cannot be made out, but from the parts that are visible the septa appear to be fairly symmetrical.

On the whole I think there cannot be much doubt about the present example being referable to Sharpe's *Ammonites Ramsayanus*. Notwithstanding the apparent symmetry of the specimen, its periphery presents certain appearances which suggest that the fossil is deformed.

One side of Sharpe's specimen, viz. that represented in his fig. 4*b*, looks something like a deformed *Ammonites Salteri*,[1] which Sharpe also described from the "Chalk with silicious grains, at Chardstock, Somersetshire," but the opposite side appears to be quite different.

Sharpe's type-specimen certainly was deformed, and I think the Bath specimen is also, but being unable to refer them to any other species which has hitherto been described from the Chalk, it seems desirable to retain, at least provisionally, Sharpe's name *Ammonites Ramsayanus*.

V.—Oscillations in the Sea-level. (Part III.)

By H. W. Pearson.

(*Continued from the May Number, p.* 231.)

Data used in showing a Period of High Sea-level in the North, culminating about the years 1475 *to* 1500.

NORWICH, England, is represented as situated on the banks of an arm of the sea even in the thirteenth and fourteenth centuries (Lyell's "Principles," 11th ed., vol. i, p. 521; S. Woodward[2]). Early in the fourteenth century Pagham Harbour was formed by a sudden inroad of the sea (Encyc. Brit., vol. xxii, p. 723).

[1] D. Sharpe: Foss. Moll. Chalk (Mon. Pal. Soc.), pt. iii, 1856, p. 50, pl. xxiii, ff. 3*a*, *b*, *c*, and 5*a*, *b*.

[2] "History and Antiquities of Norwich Castle," 1836. Plates showing the 'Yarmouth Hutch Map,' A.D. 1000, and at various other periods, earlier and later: drawn from local records and geological observations.

Town of Rye "situated upon a rocky eminence which two or three centuries ago was washed on all sides by the influx of the tides, but now, in consequence of the gradual recession of the sea, lies two miles inland" (Encyc. Brit., vol. xxi, p. 117). In Charles II's time (1660–1685) a 64-gun frigate could ride in the harbour of Rye; now a ship of half that size could not obtain an entrance (Clark's "Guide and History of Rye," p. 63). Between 1292 and 1340 upwards of 5,500 acres were submerged by the sea in Sussex (Encyc. Brit., vol. xxii, p. 723). "It is said that old Winchelsea contained 50 inns and taverns and 700 householders: here 400 sail of the tallest ships, it is said, anchored in the Camber near Rye, where sheep and cattle now feed." Three hundred houses destroyed by rising of the sea in the year 1250, and the destruction made total by the great inundation of 1287 (Clark's "Guide and History of Rye," pp. 64, 65).

Great portions of the English Fens were drowned in the years 1248, 1250, 1257, 1286, 1292, 1322, 1357, 1358; Marshland drowned in 1287, 1289, 1292, 1294, 1295, 1297, 1334, 1339, 1378, 1422, 1520, and 1569 ("The Fenland Past and Present," p. 146). "In the year 1362 the unfortunate Marshlanders show that the Lynn River, which formerly was only 12 perches broad, was then a full mile in breadth; but in the years 1378, 1565, and 1608 we find notices showing that the river was growing wider" (p. 212). Raveneserodd destroyed by the sea, thirteenth and fourteenth centuries. "1377 and 1393 appear to have been critical years in the waste of this coast" ("Lincolnshire and the Danes," pp. 239, 240). Hugh of Levens, in a petition to the Archbishop of York shortly after 1339, says, "Whereas our manors and lands of Saltagh, Tharlesthorp, Frysmerske, Wythfleet, Dymelton, and Raveneserodd were so destroyed every day and night by increasing inundations of the waters," etc. (p. 46). Towns of Holton, Northrup, and Newton destroyed at the same time (p. 49). "When Henry IV landed at Ravenspurn, June, 1399, the towns of Ravenser and Raveneserodd had long been engulfed by the waters" (p. 57). "In that time (1249 to 1269) the sea inundated and passed over its coasts almost throughout the whole eastern part of England, and the Humber, exceeding its limits, covered the land even to our fishing and wood of Cotyngham" (p. 67, quoting "Chronicles of Meaux"; Boyle, "The Lost Towns of the Humber").

"In the thirteenth century the river [Fleet River in London] was of such breadth and depth that ten or twelve ships at once with merchandise were wont to come to the bridge of Fleet and some of them to Holborn bridge" (Whealey, "London Past and Present," p. 52). After the great fire (1666) "the citizens had it deepened between Holborn and the Thames so that barges might ascend with the tide as far as Holborn as before" (p. 53). See copy of drawing on stairway of St. Martin's Free Library, London, by Anty' van den Wyngaerde (original in Bodleian Library, Oxford). Date of picture, 1543. This shows Moats of Tower on a level with the Thames and full of water. Shows also Fleet River with bridges at Fleet and

Holborn streets. There is no possible method of explaining the peculiarities of this drawing, except by the assumption that the Thames at that time stood 12 to 15 feet higher than at present.

In the History of the City of Chester, by Joseph Hemmingway, we read, "The New Water Tower was erected in the year 1322" (p. 133). "At the outside of this Tower are fixed great iron rings, being of use heretofore for mooring the ships" (p. 356). "It is certain that long before the period at which this was written [about 1706] vessels had ceased to approach this tower" (p. 356). Quoting Fuller from his "Worthies of the City" (pub. 1662), "and now being about to take our leave of this ancient and honorable city, the worst that I wish it is that the distance between the Dee and the New Tower may be made up—that the rings on the New Tower (now only for sight) may be restored to the service for which they were first intended," etc.

Castle Huntley (in the Carse of Gowrie, Scotland) was erected in 1452 (Encyc. Brit., vol. xviii, p. 667). "This castle once had rings fixed to it for mooring the boats formerly sailing on the surrounding waters" (Chambers, "Ancient Sea Margins," p. 20). This castle is now some miles from the sea, and the ordnance map of that region shows that it would be necessary to elevate the sea-level 20 to 24 feet to again allow these rings to be put to their original use. "Yet we have internal evidence from the marginal observations in one of the set of books (Records of Tide Gauges, Leith, Scotland) that in the year 1810 mean tides rose to a point 2 ft. 10 ins. higher than they do at present" (Mr. Thomas Smyth, Geol. Mag., 1866, Vol. III, p. 427). Mr. Smyth, in conclusion, stated that "The upheaval which is at present taking place on the shores of the Firth of Forth and in Berwickshire has its counterpart in Caithness, which is rising at nearly the same rate" (p. 427). The low-water level in Glasgow Harbour has fallen 8 feet since 1758: alleged cause, improvements in bed of Clyde; real cause, the so-called upheaval as shown above by Smyth (*Geological Record*, 1876, p. 10). "The encroachments of the land upon the sea are strikingly exhibited in the sandbanks and deltas of the principal bays and estuaries of the island [Arran], and there can be little doubt that a few centuries ago the ships of the islanders found a secure harbourage within the creeks and bays, where the heath and brushwood now luxuriate" (McArthur, "The Antiquities of Arran," p. 105).

The Gulf Stream Islands were discovered in 1871. "In the spot where these now are, the Dutch in 1594 found and measured a sandbank in soundings of 18 fathoms, showing an upheaval here of 100 feet in 300 years" (Journ. Roy. Geog. Soc., 1873, p. 253). We note as to this that we have no evidence that the Dutch found the shoalest water, therefore this estimated upheaval is probably considerably too large. Diomed Island (on Siberian coast), described by Chalavrof in 1760, no longer exists; it now forms a part of the main (p. 256). "From 1730 to 1839 the upheaval of Loeffgrund amounted to 2 ft. 11 ins. only" (Reclus; Harpers, "The

Earth," p. 531). "Borre, a village (in Denmark) now lost amidst the Fens, stood on the beach in 1510" ("The Earth and its Inhabitants," Europe, vol. v, p. 54). "These mountains [of Spitzbergen] increase in bulk every year, so as to be plainly discoverable. Leonin was surprised to find on the hill, about a league from the seaside, a small mast of a ship with one of its pulleys still fastened to it" (written in 1646; see Journ. Roy. Geog. Soc., 1873, p. 252). "The waters over which the French expedition measured an arc of the Meridian (Tornea, Sweden, 1736–1737) are now replaced by meadows" (Phillips, "Manual of Geology," p. 326). The general and recent so-called upheaval of Scandinavia, having been demonstrated so thoroughly through modern textbooks, I will make no further reference thereto.

Caligula erected A.D. 51 a huge tower a mile from the coast near Boulogne, France; in 1544 this tower was only 200 yards from the coast ("Antiquities of Hastings," p. 13). Aigues Mortes, a seaport in the thirteenth century, is now five miles inland (Smyth, "The Mediterranean," p. 13). "Some of the present vineyards of Agde were covered by the sea only a century ago" (written about 1850; ibid., p. 13). "The Tower of Pignaux (Lyell, Tignaux) erected on the shore in 1737; now a French mile from it" (Milner, "Gallery of Nature," p. 398). "The old port of Talmont, where Henry IV embarked his artillery (1411), has become dry land" ("The Earth and its Inhabitants," Europe, vol. ii, p. 210). The tower built by Michael Angelo in 1567 on the very edge of the coast (at mouth of Tiber) is now 2,250 yards inland (Lanciani, "Ancient Rome," p. 235). On the west side of the Gulf of Taranto a tower erected by the Angevine kings (fourteenth and fifteenth centuries) on the coast is now above a mile distant from shore (Smyth, "The Mediterranean," p. 36). Poingdestre, writing in 1685, says, "A portion of the Jersey Isles became submerged in 1356." "The Ecrehous and Dirouilles, on the north-east of Jersey, are known to have been much more extensive than at present; they also sunk probably in 1356" (R. A. Peacock in Rep. Brit. Assoc., 1865, p. 70).

The city of Foah at the commencement of the fifteenth century was on the Canopic, mouth of the Nile, now more than a mile inland (Quart. Journ. Geol. Soc., vol. iv, p. 346).

J. E. Davis says that embankments built near Tremadoc, Wales, since the sixteenth century now rendered useless by the recession of the sea (ibid., vol. ii, p. 74). Captain Marcus Jones, of Portmadoc, Wales, informed me April 12th, 1898, that his father, he thinks about the close of last century or the first of this, went with a boat to a place under Tynyberllan, a short distance to the south-east of Wern, Tremadoc, to fetch a load of American timber. To allow this to be done the sea must necessarily have stood several feet higher than at present, Wern being now at least three miles from the sea. Mr. F. L. Edwards, Harlech, Wales, in April, 1898, informed me that he saw, twenty years before, an old lady who, when she was a little girl, visited an aunt in a cottage (Cafinrhyn) about $2\frac{1}{2}$ miles north of Harlech. During the night the tide came up and she

jumped out of bed into water up to her knees. Now the tide does not come within three miles of this place. At Castle Hotel, Harlech, a picture of Harlech Castle (printed by Alex. Bogg, 16, Paternoster Row) is exhibited, showing the sea reaching to the base of the castle. Sea is now one mile distant. It would be interesting to learn the date of this picture.

The Zuyder Zee was opened at the expense of the land in the first years of the thirteenth century, "and never ceased to enlarge itself during 200 years" (Reclus, "The Ocean," p. 154). In 1230 occurred the terrible inundation of Friesland, costing the lives of 100,000 people; in 1231 the lakes of Haarlem overflowed, and gradually increasing united with each other toward 1650. In 1277 the Gulf of Dollart began to be hollowed out. It was only in 1537 that the invasion of the sea, which had devoured the town of Torum and fifty villages, could be arrested; in 1287 the Zuyder Zee drowned 60,000 persons; in 1421 seventy-two villages were submerged at once ("The Ocean," p. 154). The island of Wieringer, part of the mainland in 1205, was detached by floods in 1219, 1220, 1221, 1246, 1251. The Biesbosch, Holland, formed in 1421, twenty-two villages drowned. Inundations of the Gulf of Dollart, 1277, 1278, 1280, and 1287. The western coast of Schleswig swallowed up in 1240. Fourteen villages in Isle of Cadsand, Zealand, submerged in 1337. Kortgene Island engulfed in 1530 ("The Gallery of Nature," p. 389).

The record above given of the devastation wrought by the sea in Holland between the years 1200 and 1500 is but partial; it might be extended tenfold, but it is sufficient to show exactly what occurred on these shores during the period named. The history is plain to read; about the year 1200 the rising sea-level began to overtop the barriers erected by the people of the lowlands for the protection of their homes. Those barriers which yesterday were found ample will to-morrow be found deficient in height. The progressive rising of the sea exceeding the ability of man to elevate the embankments. The result is that during the 250 years or more which elapsed before these waters reached their highest level, the history of Holland forms one long chapter of horrors. We can see also that during the period when Holland was sinking beneath the waves the English coast was undergoing the same ordeal, as illustrated in the history of Rye, Norwich, Winchelsea, Ravenser, and the Fens, only, more fortunate than Holland, she had little low-lying lands along her borders liable to submergence; her losses, therefore, during the epoch of the advancing sea were less extensive.

The haven in which the Chinese Admiral anchored his fleet (in Formosa, 1661) "is now a dry, arid plain, over which there is a road and several canals cut to communicate with the old port of Tai-wau-fu" (Journ. Roy. Geog. Soc., vol. xliii, p. 99). "The Dutch fort of 1624, originally built on an islet at some distance from the shore, now forms part of Formosa, and under its ruins the water is so shallow that passengers land with much difficulty where was

formerly deep water" (*Science*, vol. v, p. 262). Newchang (China), once a seaport, abandoned for Taitze, on account of recession of the sea. Taitze in its turn abandoned during the present century, and Yingtze established owing to the shoaling of the water (Journ. Roy. Geog. Soc., vol. xliii, p. 258).

Indian Survey shows "it is almost certain that the mean sea-level at Madras is a foot lower than it was sixty years ago" (*Science*, vol. iv, p. 212). Gaur, or Gour, India, subject to inundation in 1590; not so now (Encyc. Brit., vol. x, p. 113). "Very curious evidence of the gradual elevation of the land, or rather of the constant retrocession of the sea, is afforded by the traditions of the community of Verawow" (India). "It is several generations since any sea-borne ships have been near this ancient port" (Journ. Roy. Geog. Soc., 1870, pp. 194–5). Adam's Bridge, connecting Ceylon and India, breached by high water in year 1480 (Encyc. Brit., vol. xx, p. 266).

Investigation near the site of the Temple of Jupiter Serapis (Bay of Baie) informs us that about 1503 and 1511 the level of the Mediterranean Sea at that point stood 20 to 22 feet higher than at present (A. J. Jukes-Browne, "Physical Geography," p. 46). "The period of deep submergence was certainly antecedent to the close of the fifteenth century" (Temple of Jupiter Serapis), (Lyell's "Principles," 11th ed., p. 173).

Henry Hudson in 1610 wintered in an arm of Hudson Bay, now impassable except for small boats. In 1674 sloop sailed through between island and the main west shore of James Bay. In 1886 it was difficult to get through this passage with canoes (Journ. Science, ser. IV, vol. i, p. 224).

This part of the island [Isle of Pines, off south-west coast of Cuba] seems to have been upheaved in relatively recent times, for even within the historical period (i.e. since 1492) various islets on the coast have been merged in continuous land ("The Earth and its Inhabitants," North America, vol. i, p. 364). "Interesting examples of recent elevation are believed to occur in the neighbourhood of Washington, D.C. In colonial times Bladensburg and Dumfries could be reached by sea-going ships, but now they are decidedly above tide-level. The change is generally supposed to be due to silting up of the creek, but this appears not to be the case, for there is little alluvium resting upon the bed-rock of the channels" (W. B. Scott, "Introduction to Geology," p. 67).

In the second volume of the Maryland Geological Survey, Mr. Edward B. Mathews discusses at length the difference existing between the ancient maps of Chesapeake Bay and the modern maps. He examines Captain John Smith's map of 1608, Herriman's map of 1670, etc. As to these differences Mathews remarks as follows:—"He [Smith] clearly mistook the deeply indented peninsulas of Dorchester and Talbot Counties for islands" (p. 354). "The rest of the shore-line indicates either a loose generalization of marshy lowlands, or that some of the smaller points and islands are

of *recent development*" (p. 355). "It may be suggested that part of the present land was then marshland" (p. 356). "A study of the shore of Somerset County (Herriman's map) seems to indicate that considerable filling in has taken place since the date of the map" (p. 381). "Portions of the coast, such as James Island Marsh, Hazard Point, and Deals Island, and possibly Nauticoke Point, are represented by Herriman as *islands clearly separated from the mainland*" (p. 381). "Seavorn River is too broad" (p. 382). South and west rivers "show the constant error of being too broad. This, however, is a feature which is common to the rivers of this and many other maps of the seventeenth and eighteenth centuries" (p. 381).

Now these data so clearly shown by Mr. Mathews lead to but one conclusion. We cannot believe that these ancient geographers made mistakes of observation always in one direction; they mapped out the present peninsulas as islands, because the sea stood higher at that time, and they were islands; they mapped out the rivers broader than now, because at that time they *were* broader, owing to the higher sea-level. The filling in has taken place; the "recent development" of islands and points and marshes has occurred, simply because the sea has fallen in the last two hundred years, and the observed change in the topography of these shores is the necessary consequence.

Zagoskin says "that the spot where the fort now stands [Fort Yukon, Alaska] has been covered by the sea within the memory of the Indians living at the date of his visit in 1842 and 1843" (Howorth in Journ. Roy. Geog. Soc., vol. xliii, p. 246). Mr. H. W. Elliot, in "The Seal and Salmon Fisheries of Alaska," vol. iii, states that when the natives first came to the Pribilof Islands, Novastoshnah was an island by itself; it now forms a portion of St. Paul's Island. (The natives came to these islands immediately on their discovery in 1766.) "The lagoon (near village of St. Paul) was then an open harbour, in which the ships of the old Russian Company rocked safe at anchor. To-day, no vessel drawing ten feet of water can get nearer than a mile from the lagoon" (p. 21).

Further to the north, at Colon and at Santa Marta and several other points of the coast of New Granada, the ground has visibly risen since Europeans first landed on the Continent (Reclus, "The Earth," p. 552). The marshes [of the Vendée, France] raised above the sea-level within historic times four centuries ago (Encyc. Brit., vol. xxiv, p. 137). "In the reign of Edward III (1327–1377) it was unlawful to bathe in the Fosse or in the Thames near the Tower, the penalty being death" ("Authorized Guide to the Tower of London," p. 11). This would show a full moat at that period. The ditch was dry in 1140. Longchamp spent a large sum of money in 1190, "but he failed to fill the ditch with water" (p. 149). The easiest explanation of the presence of water in the moat at the above date lies in the high-water period then in existence. The moat to-day contains no water whatever.

Data indicating a Period of Low Sea-level about the year 1175 A.D.

Omar, who wrote about 1050 A.D., had satisfied himself that "the extension of the sea had been greater at some former periods." He was the author of a work, "The Retreat of the Sea." We can infer, then, that he had observed indications of a recent recession of the sea—in other words, he must have lived during a *low-water period*, or at such time as the sea had already made great recession from the high-water position of 875. Bede says the Channel between the Isle of Thanet and balance of Kent was three furlongs wide in the eighth century, and it is supposed it began to grow shallow about 1066 ("Principles," vol. i, p. 529). Dantzic at the same level now as in the year 1000 ("Principles," vol. ii, p. 182). Heligoland in 1072 extended over a space of 900 square kilometres ("The Ocean," p. 153). Island at the mouth of the Bay of St. Malo formed a portion of the mainland in the twelfth century ("The Earth and its Inhabitants," Europe, vol. ii, p. 251).

Henry of Huntingdon says about 1134, "This fennie countrie [the Fens, England] is passing rich and plenteous, finely adorned with woods and islands." William of Malmsbury, who wrote about the year 1140, says, "The Fens were a very paradise, the very marshes bearing goodly trees which for tallness strived to reach up to the stars" ("History and Antiquities of Boston," p. 660). "It seems to show that Lincolnshire was then [time of William the Conqueror, 1068] a fertile corn-bearing district" ("The Fenland Past and Present," p. 98). We have already shown how this paradise, this fertile corn-bearing district—these terms describing the condition of this region during the low-water period—was later, during the advance of the sea between the years 1250 and 1500, submerged and devastated; this devastation being contemporaneous with the inundation of Holland. Dirk II received in 983 a broad district that is now covered by the Zuyder Zee (Encyc. Brit., vol. xii, p. 71). "There was [in the strait between the Isle of Thanet and coast of Kent] a considerable passage for ships till about the time of the Norman Conquest, very soon after which the inhabitants began to reclaim the land that had been formerly under water" (Wilson, "The Isle of Thanet Guide," p. 7).

Data showing the High-Water Epoch of about 875 A.D.

"In the time of Charlemagne the island [Heligoland] was not much larger than now" ("Principles," vol. i, p. 559). In the year 800 the sea carried off large quantities of soil from Heligoland ("Gallery of Nature," p. 388). In the years 800 to 900 "Tempests change the coasts of Brittany; valleys and villages are swallowed up" (loc. cit.). Channel between the Isle of Thanet and mainland was three furlongs wide in the eighth century ("Principles," vol. i, p. 529). In 660 the Rhine inundated the country ("The Ocean," p. 153). "Some antiquarians maintain that the submarine trees that occur along the coast between St. Malo and Cape La Hogue are the relics of a broad belt of forest land, which was

overwhelmed by the sea in the year 709, although the submergence was not completed until 860" (Jas. Geikie, "Prehistoric Europe," p. 481). "Migulon and Psalmody were islands in the year 815, and in 1820 they were two leagues from the sea" ("The Mediterranean," p. 13). Ferd. de Lesseps shows that eleven centuries ago (about 800) the mean level of the Red Sea was about three metres higher than now (*Geological Record*, 1874, p. 146).

Certain ancient documents now existing in the Town Hall of Rye (Charter of King Richard I, 1194, etc.) plainly show that prior to that date the sea had surrounded the town of Rye (Rep. Brit. Assoc., 1890, p. 825). "A deplorable state of the Fens (England) is depicted by some who wrote of that period (early part of eighth century). Dugdale shows that the fresh waters were of wide extent and deep" ("The Fenland Past and Present," p. 71). Again, "The Isle of Ely was, even at that early period (870 A.D.), a place of refuge; parties detached from the fleet (Danes) passed up the river in quest of booty, for such was the depth of the water, which extended to the sea, that they had an easy access into it by shipping" (p. 82). (Now Ely is 30 miles from the sea.) "The tide then, 1,000 years ago, flowed up the river Witham to Lincoln" ("Lincolnshire and the Danes," p. 195).

In the years 800 to 950 the isles of Ammiuno and Costanziaco, near Venice, disappear ("Gallery of Nature," p. 388). Notre Dame des Ports "was also a harbour in 898, but is now a league from the shore" (p. 393). Saugus Island, at mouth of River Ganges, at one time contained the largest city in India; this city was entirely destroyed by the sea 1,000 years ago (from card on exhibit in Memorial Hall, Philadelphia; authority quoted, Sir Wm. Jones). "This seems to place Lydd on the shore (year 774), though it is now nearly three miles from the shore" (Greenwood, "Rain and Rivers," p. 63). "The present position of several edifices situated in the island of Munkholm, near Trondhjiem, proves that during a thousand years the elevation of the ground has been less than 20 feet" ("The Earth," p. 532). Verawow, India, was settled more than 800 years ago. "At that time sea-going ships came with ease to the vicinity of the present town, and they still show the stone posts to which the ships were moored" (Journ. Roy. Geog. Soc., 1870, p. 195). "About the year 850 there occurred a fearful inundation of the Tigris" ("The Remains of Lost Empires," p. 260).

Data as to Low-Water Period of about 600 A.D.

The Archipelago of Chausey is stated in the "Lives of the Saints" to have formed part of the mainland in the beginning of the eighth century, the area now covered by the sea being then occupied by a vast forest (Reclus, "Europe," vol. ii, p. 251). It is well known that previous to A.D. 709 the whole Bay (Bay of Mont St. Michel) as far as Chausey rocks, and for a considerable breadth northwards as far as Cape La Hague and the country southwards as far as Dol, was the forest of Scisey (Rep. Brit. Assoc, 1865, p. 70). "It is certain that Mont St. Michel, which

contains now only about 20 acres, was immediately previous to A.D. 709 six miles long by four broad and covered by forests" (loc. cit.). Abbey of Whitby, erected in 658, is reported to have been a mile from the sea. The distance in 1816 was little more than 200 yards ("Gallery of Nature," p. 394). The passage between the Isle of Thanet and the coast of Kent, which remained in "perfect state" so long as the Romans remained in Britain, "in Bede's time (circ. 675 to 735), and perhaps an age before that, began to decline by diminishing its breadth, etc." (S. R. Wilson, "The Isle of Thanet Guide," p. 6).

Data as to High-Water Period of about 350 A.D.

Norwich, "in the time of the Saxons, was situated on the banks of an arm of the sea, an estuary which has since become a region of cultivated fields" ("Gallery of Nature," p. 396). "The former Roman port of Alaterva (Cramond, Scotland), the quays of which are still visible, is now situated at some distance from the sea, and the ground on which it stands has risen at least 24½ feet." In other places the débris scattered on the bank show that the coast has risen about 26½ feet. Now by a remarkable coincidence the ancient wall of Antoninus, which at the time of the Romans served as a barrier against the Picts, comes to an end at a point 26 feet above the level of high tides" ("The Earth," p. 537). The Isle of Thanet was separated from the rest of Kent in the time of the Romans by a navigable channel, through which fleets sailed ("Principles," p. 529). During the course of the third century tradition tells us that the island of Walcheren was separated from the Continent (Reclus, "The Ocean," p. 153). "The Hythe coast must have risen quite 30 feet since Roman times" (Geol. Mag., April, 1885, p. 145). Valerius Maximus states that a bank was erected in 230 A.D. to keep out sea and storm from the Temple of Serapis (Quart. Journ. Geol. Soc., 1847, p. 213). Note this is evidence that the sea was rising at that time, and had reached an elevation about equivalent to its present level.

Sir Charles Lyell and Sir Archibald Geikie believe with many others, including Smyth, that there had been a considerable upheaval of the shores of the Firth of Forth since the period of the Roman occupation (Geol. Mag., 1866, p. 426). Mr. Smyth shows on the same page that the upheaval must have been at least 24½ feet. Mr. G. A. Lebour argues from the standpoint of geology, tradition, and history that the city of Is in Lower Brittany was submerged in the reign of King Gradlou, in the fourth or fifth century (Geol. Mag., 1871, p. 300). Sir J. A. Picton describes a Roman wharf in the Rood-eye (Chester), now the racecourse, but formerly a haven for ships, with a considerable depth of water (Proc. Liverpool Geol. Soc., vol. vi, p. 39). Note ordnance map (6 in.), No. 38–11–16; seems to show that a rise of the sea-level equivalent to 24 or 25 feet would be necessary to allow this ancient dock or this old haven to be again put to their original uses.

Hengist and Horsa, the Saxons, landed at Ebb's Fleet, Thanet,

in 449; as this point is now 1½ to 2 miles back from the present coastline, it would seem that the sea must have stood at least 15 feet higher on those coasts at that date than it does to-day. Mr. J. E. H. Thomson draws attention to a passage in the "Acta Petri et Pauli," which passage leads him to suggest that the submergence of the Temple of Serapis probably occurred between the "middle of the third century and the middle of the fourth" (Bonney, "The Story of our Planet," p. 203).

Data as to Low-Water Period of 80 A.D., *showing also that the sea-level was then lower than at present.*

Septimus Severus between 194 and 211 A.D. decorated the Temple of Jupiter Serapis. Alexander Severus did the same between the years 222 and 235 A.D. These facts indicate a low-water period at that time ("Principles," 11th ed., vol. ii, pp. 171, 172). Pliny (before 79 A.D.) visited the Straits of Gibraltar, and speaks of a low-lying island upon which were the remains of the Temple of Hercules. Pomponius Mela about the same time describes the straits as broken by a number of small islands; all these islands are now submerged. In 1728, during an extraordinary low tide the remains of this temple were clearly seen, and souvenirs obtained from the ruins (*Science Record*, 1876, p. 543). St. Paul embarked from Assus over a mole now visible under the clear water (Encyc. Brit., vol. xxiii, p. 580). At date of 9 B.C. St. Michael's Mount, Cornwall, seems to have been at the same level with regard to the sea as now ("Principles," vol. i, p. 544). In the island of Capri one of the palaces of Tiberius (14 to 37 A.D.) is now covered with water (vol. ii, p. 176). He (Strabo, about 54 B.C. to 20 A.D.) has brought together a large amount of material to throw light upon the changes which have passed over the face of the earth owing to the retirement of the sea (Tozer, "History of Ancient Geography," p. 251). The island of Batavia, inhabited in the days of Tacitus, is drowned (Journ. Science, ser. III, vol. xliv, p. 179).

Mr. R. A. Peacock, in Rep. Brit. Assoc., 1865, shows that in the time of Ptolemy (say 100 to 175 A.D.) the coast of Normandy probably extended seventeen miles west of its present position, that Mont St. Michel at one time was ten leagues from the sea, and states his belief that "Jersey was not an island until after Ptolemy's time." The entrance to the Gulf of Corinth, which in the time of the Peloponnesian War (1st, 2nd, and 3rd, between years 431 and 404 B.C.) had a width of seven stadia, had become reduced in Strabo's time to a breadth of five stadia ("The Earth and its Inhabitants," Europe, vol. i, p. 50). "From which account it sufficiently appears that the most considerable part of the great level (in Fens of England) was anciently sound dry land by nature, well furnished by timber, trees and woods. That this was the state of the great level when the Romans entered the island, is highly probable" ("The Fenland Past and Present," p. 29, quoting from Estobb; Romans invaded England 43 A.D.). Caligula's tower, previously mentioned as showing the high-water period of 1500,

and which was undermined by the sea in 1644, can also be used to show the low-water stage at its time of erection (51 A.D.), as it was then a mile from the sea. Pliny counted twenty-three islands between the Texel and the Eider. Now only sixteen, and those greatly diminished in size ("Principles," 9th ed., p. 329). "Pliny states that the city of Apologos (at the head of Persian Gulf) was originally only ten miles from the sea, but that in his time the existing place was so much as 120 miles from it" (McCrindle, "The Com. and Nav. of the Erythræan Sea," p. 104). Jersey was probably part of the Continent in Cæsar's time and still later (Peacock, "Vast Sinkings of Land," p. 13).

Data as to High-Water Period of about 250 B.C.

The two piers of the port of Phalasarna, a city of late Hellenic date, are now 22 feet above their original level (Prestwich, "Tradition of the Flood," p. 57). The Gulf of Poitou (France) 2,000 years ago was 18 to 20 miles wide, now but a small bay known as the creeks of Aiguillon (Reclus, "The Earth," p. 541). Bay of Tunis, once a deep and open harbour, now has only 6 or 7 feet of water. Shaw identifies at a point now inland, but which must anciently have been on the seashore, the 'Port' (now village of El Mersa) as the ancient harbour of Carthage (Smith's Dict. Greek and Roman Geog., pp. 531–2). It is certain beyond question that the high-water stage shown above for the Bay of Tunis and harbour of Carthage was in existence during the period of the three Punic wars, or from 264 to 146 B.C. Aleria or Alalia (a city of Corsica), a seaport in Roman times, captured by the Roman fleet 259 B.C., is now above half a mile from the coast (ibid., p. 94). At the time of Herodotus (died 425 B.C.) the mountain of Lade was an island; at the present time it forms part of the mainland ("The Earth," p. 542).

Admiral Smyth shows in "The Mediterranean," p. 73, that this island of Lade sheltered the Athenian fleet A.C. 412 or 341 B.C., and alleges as the cause of junction between the islands and the mainland the silting action of the Meander River. On the other hand, Reclus ("The Earth," p. 542) denies the competence of silting to explain the changed topography of the shores of Asia Minor, and says, "It must therefore be in consequence of a slow upheaval of the earth's crust that the ruins of Troy, Smyrna, Ephesus, and Miletus have gradually become more distant from the coast and appear to be receding still further inland." Tyre was an island up to the time of Alexander's siege (322 B.C.). The present harbour is not so large as it once was. The other ancient harbour has disappeared (Encyc. Brit., vol. xxiii, p. 711).

The town of Putai (China), said to have been on the coast twenty-one centuries ago, is now over forty miles away ("The Earth and its Inhabitants," Asia, vol. ii, p. 104). In twenty-two centuries the Rhône delta has run out 26 kilometres into the sea (*Geological Record*, 1875, p. 82). The coastline of Tunis has increased outwards nearly 100 square miles in area since the third century B.C. This

has led Th. Fischer to include Tunis in the lists of rising coasts, with Sicily, Sardinia, and South-Eastern France. Dr. J. Partsch, of Breslau, questions this conclusion, and alleges the cause to be delta growth in combination with wind action, by which sand has been blown inland from the shore (*Science*, vol. ii, p. 142). The position of Dr. Partsch seems refuted by the same arguments used by Reclus, in the case of Sicily and coasts of Italy, Greece, Malta, Rhodes, Cyprus, Crete, Asia Minor, Lisbon, Issa, Antissa, etc. In all these cases the silt carried by the rivers is entirely inadequate to explain the facts; it is necessary, therefore, to invoke either upheaval of the ground or recession of the sea (see "The Earth," p. 542).

"The Cimbrian Deluge (submergence of Jutland) is supposed to have happened about three centuries before the Christian era" ("Principles," 9th ed., p. 331). A portion of the walls of the city of Utica washed by the sea at siege by Scipio Africanus about 205 B.C. (Livy, Book xxix, chap. 34). Sea now many miles distant. "Scipio was obliged to transfer his camp to an adjoining tongue of land (Ghella), then washed by the sea, but now far inland, which was known for centuries afterwards as the Castra Cornelia. So ended the year B.C. 204" ("Carthage and the Carthaginians," p. 296). Lake Mareotis in the time of Alexander the Great a large body of water navigable for the largest vessels, but now little more than a swamp (Professor Wheeler in Century Mag., May, 1899, p. 28). In the time of Alexander great inundations in Arem (Arabia) compelled eight tribes to fly their dwellings in Yemen and migrate to other lands ("The Cottage Cyclopedia," p. 61). Helice and Bura in Greece were swallowed up by the sea during an earthquake in 373 B.C. ("The International Atlas," p. 11). At the capture of Tarentum by Hannibal, about 213 B.C., the sea washed the greater part of the citadel (Livy, Book xxv, chap. 11).

NOTICES OF MEMOIRS.

I.—Petroleum in California. Professor E. W. Claypole: The American Geologist, vol. xxvii, pp. 150–159, March, 1901.

THE Californian oil-wells supplied the amount of 12,000 barrels in 1870; but a progressively larger quantity has been obtained, until in 1899 it was 2,665,709 barrels. It is remarkable that the wells are relatively shallow, and that none of the oil-bearing strata are older than the Cretaceous age: thus, at Stockton they are Quaternary; at Puente, Los Angelos, and Kern Co. they are Pliocene; at Ventura, Los Angelos, Kern Co., and Newhall they are Miocene; at Ventura, Fresno, and Kern Co., Eocene; at Colusa Co. and Sacramento Valley they are of Cretaceous age. The strata of California have been greatly disturbed in comparatively recent times. The final elevation of the Sierra Nevada and the Coast-range is apparently of not earlier date than the Pliocene period. The oil-bearing beds usually consist of sandstone interlaminated with

shale; and is chiefly stored in the former. Professor Claypole states that the anticlinal theory explained by Professor I. C. White in Pennsylvania holds good for California. —T. R. J.

II. — Maryland Geological Survey: Alleghany County. (Baltimore, 1900, pp. 323.) — William Bullock Clarke and his staff have produced one of those interesting volumes we are so accustomed to see from the United States, and which are so well printed in comparison with those published by our own Government. The Physiography, by Cleveland Abbe, is illustrated by a photograph of a model of the county, from which the student can see at a glance the general features of the land, and thus clearly follow the descriptions of the author. Next comes the Geology, by C. C. O'Harra. This includes Silurian to Permian beds overlain by alluvial and other late deposits. The Minerals, Soils, Climate, Hydrography, Magnetics, Forests, Flora, and Fauna are all treated of in detail. The whole is illustrated in the usual manner by excellent reproductions from photographs, and a bibliography of 175 items is furnished. Among the maps provided are, one showing the wooded areas, another showing the magnetic declination, and a third showing structural sections. These latter are geological sections across the county at regular intervals, and give the reader a better idea of the features than pages of descriptive writing. A good index completes the volume.

III. — The Carboniferous System in Eastern Canada.— Dr. H. M. Ami writes in the Trans. Nova Scotia Inst. Sci., vol. x, on the subdivisions of the Carboniferous system in Eastern Canada, with special reference to the position of the Union and Riversdale formations of Nova Scotia, referred to the Devonian system by some Canadian geologists. He discusses the evidence afforded from a study of plant and animal life, and of the marine sediments. He has come to the conclusion that the two formations mentioned above belong properly to the earliest times of the Carboniferous, and proposes to include them in that system under the name of Eo-Carboniferous. Dr. Ami seems to have taken a good deal of trouble in arriving at his conclusions, and has submitted collections of the fauna and flora to certain specialists so as to get independent opinion as to their several ages.

IV. — Edinburgh Geological Society. (Transactions, 1901, vol. viii, pt. 1.)—Petrology is to the fore in this part. Kynaston has a paper on contact metamorphism round the Cheviot Granite, and writes on Tuffs associated with the Andesite Lavas of Lorne. Mackie gives seventy analyses of rocks chiefly from the Moray area, and has a paper on differences in chemical composition between the central and marginal zones of granite veins, with further evidences of exchanges between such veins and the contact rocks. Hinxman describes spherulitic felsite from Glen Feshie. Stratigraphy is handled by Goodchild, who deals with recent exposures of rock in Edinburgh, one section being under the site of the new offices of

the *Scotsman*; by Wallace, who writes on the geology of Strathdearn; Kirkby, on Lower Carboniferous of Randerstone in Fife; and Cadell, on the geology of the oil shales of the Lothians. Jessen, of the Geological Survey of Denmark, has an interesting paper on the Pleistocene shell-bearing clays in Kintyre, clays which were investigated by a committee of the British Association in 1895–6. Palæontology is poorly represented: Kirkby deals with Ostracoda from the *Scotsman* section mentioned above, but nothing new is recorded; Simpson and Hepburn write on mammalian bones found during excavations at Hailes Quarry, near Edinburgh. These consist of fragments referable to red deer, horse, ox, goat, and field-vole. Mr. James Simpson, who died before the publication of his paper, receives a sympathetic notice from his colleague. Some notes on the distribution of erratics over Eastern Moray, by Mackie, concludes the contents of this part.

V.—Journal of the Geological Society of Tokyo: vol. viii, No. 89, Feb. 20th, 2561.—Things move fast in Japan; here we are still in the twentieth century. The publications of the Japanese Survey are too well known to require mention to the readers of the Geological Magazine, but we may certainly call attention to the opening of the twelfth volume of the Journal of the Geological Society of Tokyo. The Journal, which, with the exception of the "Table of Contents" upon page 1 of the cover, is all printed in the usual Japanese characters, opens with "A Geological Disturbance near Handayama," by K. Inoue, but from the text we are uncertain whether or not it was of Old Red Sandstone age. Mr. Iki has a paper on the geology of the Middle Kiushiu, and Hirabayashi writes on the province Kian Si. The Shidara Tertiary Basin in Mikawa is continued from the last part by Ishikawa, and Yoshida contains his report on the southern part of Higo. Those suffering from Ammonititis will find a fascinating paper on the Genealogy of the Genera *Puzosia* and *Desmoceras* by H. Yabe. In this paper full justice is done to previous authors, the various species are discussed and grouped, and their development carefully considered. Perhaps to a Western eye the relationships of the various characters seem a little mixed, but they are very clearly printed.

VI.—Geology of Hawaii.—As might be expected, the newly annexed Hawaiian Islands have been descended upon by United States geologists, and we have for notice a report by C. H. Hitchcock on the geology of Oahu. This was read before the Geological Society of America, August 22nd, 1899, and issued in the *Bulletin* February, 1901. The author can scarcely complain of hasty publication. Naturally the bulk of the geology is volcanic, but there is an interesting chapter on certain calcareous and tufaceous beds near Diamond Head, by W. H. Dall. Dr. Dall considers the conditions to be incompatible with the reference of these fossiliferous beds to a period as late as the Pleistocene, but the fossils have every characteristic of those generally assigned to the Pliocene or Upper Miocene in their general aspect and state of fossilization. There is

a breccia in the same locality, 25 feet thick, which is full of fossil land-shells, all such as have their representatives in the valleys of Oahu, though some of the species may be extinct. Professor Lyons, who first noticed these shells, concludes that "the fossils belong to a period previous to that of the receding of the ocean to its present level. That event may have been coetaneous with the change of level in the circumpolar area which marked the close of the great Glacial period, and the evidences that our climate was, previously to that time, more humid than at present, are confirmatory of that view." Towards the north there is a ledge of coral 79 feet above the sea, at Kahe, and 730 feet distant from the water, south of Puu o Hulu, he mentions another ledge 56 feet above the sea and a quarter of a mile inland. At the south end of the ridge, called Mailiilii, the limestone reaches the height of 81 feet; and at other localities on the coast, limited areas of the same substance more or less elevated have been observed. The volcanic areas are fully described and illustrated.

VII.—Glaciation in South Africa.—The Orange River Ground Moraine forms the subject of a communication to the Transactions of the Philosophical Society of South Africa (vol. xi, pt. 2, Sept., 1900), from the pen of A. W. Rogers and E. H. L. Schwarz. They give four excellent photographs. The deposit covers a wide area in the Prieska and Hope Town divisions of the Colony, and consists of a peculiar conglomerate, first noticed by Wyley in 1859. The authors arrive at the following conclusions:—"The appearances seen in the three localities, Jackal's Water, Klein Modder Fontein, and Vilet's Kuil, at considerable distances apart, can be satisfactorily explained only on the supposition that the country was traversed by land-ice; and the presence of the till-like variety of the conglomerate in the same district, probably about the same localities, confirms that explanation. Unfortunately the exact nature of the conglomerate at the three localities is unknown, that is, whether it is a true till or whether it is a stratified rock with glaciated pebbles. We only know that the rock contains numerous scratched pebbles and boulders; but this is a small point and does not affect the confirmation. It is evident that the country was depressed under water after the formation of the till of Prieska, and it is quite possible that sedimentary rocks were deposited on a floor consisting partly of till and partly of the floor from which the soft till had been removed, or on which no accumulation had taken place."

VIII.—Geology of India.—From the "General Report on the work carried on by the Geological Survey of India for the period from the 1st of April, 1899, to the 31st of March, 1900," we gather a favourable impression of progress. In the Museum the minerals have been rearranged and the rock collections put in stratigraphical order in accordance with the new edition of the "Manual of Indian Geology." A large amount of time was occupied by the preparation of the specimens for the Exposition at Paris, which were placed in the charge of Mr. T. R. Blyth. The palæontological work of the

year is as follows:—Dr. Noetling has finished the Miocene fossils of Burmah, a work which has proved that an intimate connection must have existed between the Eocene fauna of Europe and the Miocene of Burmah, a connection which can only be explained by the theory of a migration of species from west to east, which commenced with the Eocene period and lasted probably up to quite recent times. Dr. Noetling also made a magnificent collection of Permian and Triassic fossils from the Salt Range and from the Tertiary of Sind. Dr. Krafft made an examination of the Triassic fossils of the Himalayas. These consist for the greater part of Cephalopods, and include representatives of the whole series of the Trias. The chief stratigraphical result to which these palæontological researches have led is, that the *Otoceras* beds of the Himalayas do not, as was hitherto believed, correspond to the beds at the base of the lower Ceratite marls and the lower Ceratite sandstones, and very probably include also the lower Ceratite limestone; while, on the other hand, the upper division of the Lower Trias of the Himalayas ('*subrobustus* beds,' Diener) does not correspond to the whole of the Ceratite sandstones, but merely to the two upper divisions of the same, viz. the *Stachella* beds and the *Flemingites flemingarius* beds. Large collections were made by La Touche, Smith, and Walker from the Kumaon Himalayas, and a quantity of Silurian or Devonian fossils were obtained from the Shan Hills, Burmah, by La Touche, Middlemiss, and Dutta. The economics consist of enquiries into the gold of Burmah and of Southern India, and for this purpose Dr. Hatch was specially appointed for one year on March 31st, 1900. Nothing important as regards coal was done last year, but it is noted that sufficient coal is in sight for the requirements of the Jodhpur-Bikanir Railway for a space of 15 years. Mr. Holland has suggested measures to prevent the occurrence of landslips in Darjeeling in the future, and a good deal of attention has been given to the important subject of irrigation. Reports of the progress made with the surveys of Burmah, the Madras Presidency, Central Provinces, Punjab, Himalayas, Sind, and Baluchistan are included; and special reports on the auriferous reefs of Wainad, by Hayden; the auriferous tract of Wuntho, by Stonier; the Rampur Coalfield, by Reader; Sohagpur Coalfield, by Reader; Geology of the Northern Shan States, by La Touche; Geology of the Mandalay-Kunlon Ferry Railway, by Datta; Southern Shan States, by Middlemiss; Ganjam District, by Smith; Jeypore Zemidari, Vizagapatam, by Walker; Spiti, by Hayden; Mesozoic Rocks of Spiti, by Krafft; and the relationship between the *Productus* Limestone and the Ceratite Formation of the Salt Range, by Noetling, complete this very interesting report.

IX.—Former Extension of Rhætic Strata over Arran. (Transactions of the Edinburgh Geological Society, vol. viii, pp. 1 and 2.)—Mr. Goodchild contributed a paper dealing with the hæmatite which occurs in the joints of the basalt on the summit and other elevated parts of Arthur's Seat, and gave reasons for regarding it as due to some cause which, in other parts of the Lothians and Fife, has locally stained the Carboniferous rocks various shades of Indian-red,

and has converted the limestones into dolomites. Such effects, he explained, could elsewhere be traced with certainty to ferruginous and magnesian infiltrations, which had soaked down from the New Red rocks into the strata upon which they might happen to lie. He was therefore disposed to refer the hæmatite in question to deposition from such a source, and to regard the summit of Arthur's Seat as the modified descendant of the surface over which, in past times, the New Red rocks had extended.

X.—Ancient Volcanos in Arran.—On the Upland between Brodick and Drumadoor Bays, in the island of Arran, Messrs. B. N. Peach and W. Grinn, of the Geological Survey, have discovered the site and ruins of a very large volcano, covering an area of seven or eight square miles. It is represented by an accumulation of old scoriæ, broken rocks, and intrusive lavas, such as are usually found in similar basal wrecks of volcanos, whether of Jurassic, Cretaceous, or Tertiary age, in the Hebrides and Western Scotland. In this case, however, Mr. E. T. Newton has detected Rhætic fossils in some of the fragments embedded on the ruined volcano, and constituting the only record of strata once extending from Mull to Antrim. Thus they supply one proof of the enormous denudation which has taken place on the west coast of Scotland during the later part of the Tertiary era.

XI.—Geology of India. (Memoirs of the Geological Survey of India, vol. xxx, pt. 2, 1900; vol. xxxiii, pt. 1, 1901.)—The first of these memoirs contains Thomas H. Holland's Geology of the neighbourhood of Salem, Madras Presidency, with special reference to Leschenault de la Tour's observations. Leschenault collected petrological specimens from the district early in the last century (1816–1821), and it seemed desirable to obtain information concerning the geological relations and exact localities of his specimens. Lacroix described the rocks, which are preserved in Paris. They may be divided into (1) fundamental biotite-gneisses, (2) schists, (3) pyroxene-granulites (charnockites), (4) younger igneous intrusions. The exact localities have been traced and the specimens identified. A map accompanies the paper. The second memoir is by F. H. Hatch, and deals with the Kolar Goldfield, with a description of quartz mining and gold recovery as practised in India. The field bears a striking resemblance to the gold districts of Rhodesia. It consists of a belt of schists containing quartz-veins, and is part of the Transition Rocks, separated by Bruce-Foote and given the name of 'Dharwar System.' There is an appendix on the petrology by T. H. Holland.

XII.—Fossil Foraminifera of Servia. (Pavlovic, P. S. "Foraminiferi iz drugho-mediteranskikh slojeva u Srbiji paleontologhka studija." Spomenika (being the Trans. Acad. Sci. Belgrade), vol. xxxv, 1900, pp. 61–91.)—Professor Pavlovic is already known to us by a previous publication on the above subject, which appeared in *Ghlasa*, vol. lvi, 1898. This appears to be a report on the II Mediterranean beds, so far as relates to Servia, and will be of

value for comparison with the fauna of those beds in Austria. Professor Pavlovic has carefully consulted previous authors, and thereby avoided the wholesale founding of new names; but unfortunately he does not figure his new species, and we are not sufficiently acquainted with his language to rightly comprehend his descriptions. We hope that in future he will be able to furnish a German, French, or English translation of the diagnosis of new forms, as otherwise his labours will be a closed book to most. The publications of the Servian Academy contain much important matter on the little-known geology and zoology of the country.

XIII.—Geology of Egypt. (Geological Survey Report, 1899, pt. ii. Survey Department, Public Works Ministry. Cairo, 1900.[1] "Kharga Oasis: its Topography and Geology." By John Ball. 116 pp., 19 maps and plates.)—This is the second of a series of reports on districts in Egypt, the first of which has not yet reached us. The district dealt with lies between the parallels of 26° and 24° north latitude, to the west of the Nile. The geological formations met with are the Cretaceous, represented by Nubian Sandstone and clays, *Exogyra Overwegi* series, 'Ash-grey Clays,' White Chalk with *Ananchytes ovata*; Eocene, represented by Esna shales, *Lucina thebaica* and *Operculina libyca* limestones, Upper Limestone; Pleistocene and Recent, calcareous tufa and sand dunes. The topography of the Oasis is described in chapters under the general headings of "The Limiting Escarpments," "The Hills within the Oasis," "The Floor of the Oasis, with its Villages and Wells," "Antiquities." Some twenty pages are devoted to the descriptive geology; the Cretaceous beds are correlated with the Senonian (?) and the Upper and Lower Danian; the Eocene beds seem to belong to the lowest fossiliferous beds of the system. Mr. Ball gives an interesting observation on the denuding power of the sand in windy weather: a piece of tin plate exposed for two days had all its tin coating removed, and a bottle was rendered quite dull in the same time by the scratching. Where objects are protected from the sand, as at Dush, where are inscriptions in red ochre on hard white chalk, painted some 1,400 years ago, they remain in perfectly fresh state; rain being unknown, and frost practically so. The maps and sections appear to be excellent, and the whole report is of much value to the geologist and Egyptologist. We trust that the whole of Egypt will be described in a like manner.

XIV.—Shorter Geological Notes.—Mr. James Mansergh delivered an interesting Presidential Address to the Institution of Civil Engineers on November 6th, 1900. His subject was Water and Water Supply. After a capital sketch of the works of the ancients in this direction, especially those of the Romans, he dealt with the law of underground water, dowsing, typical city waterworks, etc. Mr. Mansergh approved of the Duke of Richmond's Commission for buying out the London Water Companies, which reported in 1869, and also considered the finding of Lord Llandaff's Commission of 1899 a workable scheme.

[1] This Report, though dated 1900, was *not issued until* April, 1901.

Sir John Evans, at the opening meeting of the 147th session of the Society of Arts, November 21, 1900, read an address on "The Origin, Development, and Aims of our Scientific Societies." Among other matters of interest, he mentioned that in England the Society of Antiquaries seems to be the oldest body which met for definite purposes of enquiry. About the year 1572 "divers gentlemen of London, studious in antiquities, formed themselves into a College or Society of Antiquaries." The address gave an excellent general account of the various London Societies.

Dr. Gregory's "Plan of the Earth and its Causes" is appearing in the monthly numbers of the *American Geologist*. To the March number of this journal J. B. Hatcher contributes an exceedingly useful account of the Lake Systems of Southern Patagonia, with a map.

Among the recent publications of the Royal Dublin Society (Sci. Proc., ix) will be found two papers of special interest to geologists by Professor Joly. One is on the inner mechanism of sedimentation, and deals with the fact that the presence of dissolved salts accelerates the precipitation of finely divided matter, such as clay, etc., suspended in water; the other concerns the theory of the order of formation of silicates in igneous rocks.

With the view of throwing further light on the strength and durability of slate as a roofing material, Messrs. Mellard Reade and Holland have compared the Phyllades of the Ardennes with the slates of North Wales in the Proc. Liverpool Geol. Soc., 1899–1900. The object of the authors has been, "amongst other things, to discover, if possible, upon what composition or causes the perfection of slaty-cleavage depends, and furthermore, to find out to what qualities and composition the characteristics and enduring properties of roofing slates can be attributed."

MM. Lohest and Forir, in their study of the relative age of the rocks composing the Cambrian *massif* of Stavelot, have arrived at the conclusion that the *massif* is formed of a succession of sharp and reversed folds, becoming stronger towards the north, and consisting of Devillian, Revinian, and Salmian deposits, mainly quartzites and phyllades. The paper appeared in the Bull. Sci. Assoc. Élèves Écoles Special Liège, 1900.

Captain Hutton read before the Otago Institute a general but up-to-date account of the geology of New Zealand. The paper was published in the Trans. New Zealand Inst. for 1899. There are a few footnotes of critical value.

Mrs. Gordon's paper on "The Crust-Basins of Southern Europe" has appeared in English in the Verh. VII Internat. Geogr.-Kongress. Berlin, 1899 (1900). In general terms Mrs. Gordon states that "Cross movements in the Earth's crust have as resultants a spiral movement in one sense, accompanied in a neighbouring region by a spiral movement in the opposite sense." The paper must be read to be understood; an abstract would be of little use to the student.

Dr. Henry M. Ami has published in the *Canadian Record of Science*, vol. viii, under the title of "Progress of Geological Work in

Canada during 1899," a list of papers, arranged alphabetically under authors, published in 1899.

The Bulletin of the Natural History Society of New Brunswick, No. 19, 1901, contains papers on Cambrian Fossils from Cape Breton, by G. F. Matthew; on a new genus (*Acrothyra*) of Etcheminian Brachiopods, from the Eo-Palæozoic of Cape Breton, by the same—it is near *Acrotreta*; and on the physiographic origin of our Portage Routes, being a note on the physiography of New Brunswick, by W. F. Ganong.

Sir Archibald Geikie has recently issued a third edition of his well-known work on "Scenery in Scotland," viewed in connection with its Physical Geology.

According to the Annual Report of the Yorkshire Philosophical Society, the York Museum has acquired a collection of rocks and minerals which belonged to the late Professor Piazzi Smyth. No new fossils were purchased during 1900.

From the Report of the Rugby School Natural History Society, we learn that Mr. Beeby Thompson has assisted in the arrangement of the collection of local fossils, and has presented a series found during the cutting of the Great Central Railway in that neighbourhood.

The geology of the Isthmus of Panama forms the subject of a paper by O. H. Hershey in the Bull. Dept. Geol. Univ. California, vol. ii, No. 8, 1901. The author inclines to the belief that the earliest stratified rocks are of Jurassic age; the next, the Montijo conglomerate, seems to be of early Cretaceous age; while between this and the Tertiary basal conglomerate come the Santiago sandstone and shale. The fossils apparently are too poor to allow of exact determination at present. The Tertiaries and the Pleistocene seem well developed, and there has been a recent depression of the coastal land, especially on the Pacific side. A curious fact mentioned by the author is that about a third of the paving blocks in the town of Santiago, whose population is about 6,000, are silicified wood of pre-Pleistocene age. This paper is really a supplement to that published by R. T. Hill, in 1895, in Bull. Mus. Comp. Zool. Harvard, vol. xxviii.

The Report of the Bristol Museum for 1890 notes the acquisition of a large number of fossils from the Great Oolite of Minchinhampton, and a cast of the *Archæopteryx*.

Mr. R. A. Buddicom reprints from the *Border Counties Advertizer* for last December, a short article which states that the collections at the Shrewsbury Museum have been entirely remounted and rearranged by himself and Dr. Callaway. We are glad to hear it, and hope that Owen's type-specimen of *Rhynchosaurus* is now better cared for than it was a few years ago.

In the Proc. Cotteswold Nat. Field Club, vol. xiii, pt. 3, S. S. Buckman reports the excursions for 1899 from the point of view of the features of rivers and their valleys; in part 4 (1901) the same author writes on Homœomorphy among Jurassic Brachiopoda, a paper we hope to notice in due course.

REVIEWS.

I.—Catalogue of the Mesozoic Plants in the Department of Geology, British Museum (Natural History). The Jurassic Flora: I. The Yorkshire Coast. By A. C. Seward, M.A., F.R.S., F.G.S. With 21 plates, and 53 figures in the text.

MR. SEWARD'S Catalogue of the Fossil Plants of the Wealden, published for the Trustees of the British Museum in 1894 and 1895, is already well known to palæontologists, who will welcome the present further instalment of his valuable investigation of the British Mesozoic Flora. The Inferior Oolite of the Yorkshire coast district from Filey to the north of Whitby is peculiarly rich in vegetable remains, which have been well known since the days of William Bean and the elder Williamson. Indeed, Mr. Seward tells us that nearly the whole of the material at present available was obtained by these early investigators, and that very little serious collecting has been undertaken during the last half-century. Consequently, the author's work has consisted in the revision of material already rendered classical by the investigations of a series of palæontologists, chief among whom was Adolphe Brongniart, to whom a number of the specimens were submitted in the early days of his long scientific career. Owing to the energy of the Yorkshire naturalists during the first half of the past century, specimens are abundant, and to be found in nearly every museum in this country as well as in several of the Continental collections. Under these circumstances many novelties are not to be expected, and, as a matter of fact, only two out of the fifty-five species described are new. The value of the Catalogue consists in accurate discrimination and judicious estimation of affinities, and in its affording a connected view of the whole flora, so far as at present known. Such a revision was urgently needed.

The fine illustrations form a striking feature of the volume. The 21 plates have been beautifully drawn by Miss G. M. Woodward, while some of the numerous figures in the text are the work of Mrs. Seward. The figures afford ample proof of the fine preservation of many of the specimens. The only matter for regret is that none have been found in a petrified condition, so that the study of internal structure has been impossible. Hence, many questions of affinity have had to be left open which might have been cleared up if anatomical evidence had been available. In certain other localities the student of Mesozoic Botany is more fortunate in this respect, and indirect evidence derived from such petrified specimens has proved all-important, especially in the interpretation of the Cycadean remains.

After a short historical sketch, and a rapid survey of plant-bearing deposits of similar horizon in other parts of the world, the author proceeds to the systematic description of the fossils. No Algæ remains worth consideration have been discovered, and the record begins with the Hepaticæ, to which one thalloid species—*Marchantites erectus*—is referred. The great mass of the specimens, however, is

divided between the Pteridophytes and the Gymnosperms, Angiosperms being so far entirely unrepresented, as is still the case even in the more recent Wealden beds.

Under the Equisetaceæ two species of *Equisetites* are described, plants wonderfully similar in aspect to the recent Horsetails, but often of enormous dimensions, *E. Beani* attaining a circumference of 30–40 cm. (not millimetres as erroneously printed on p. 64). The author finds reason to believe that these large stems, like their still larger Palæozoic allies, probably grew in thickness by the development of secondary vascular tissue.

One species—*Lycopodites falcatus*—is referred to the Club-Mosses, and regarded as more nearly allied to the genus *Selaginella* than to *Lycopodium*. The apparently heterophyllous character, on which this conclusion is based, is not, however, a decisive argument, heterophyllous species also occurring in the genus *Lycopodium*.

The Ferns are, of course, abundantly represented; the author describes twenty species, and less cautious taxonomists would add largely to their number. The Matonineæ, a family of which the author has treated at length elsewhere, are illustrated by some splendid specimens of *Matonidium* and *Laccopteris*. The evidence appears fully to justify the author in his opinion that this group, now so restricted, played an important part in the earlier Mesozoic vegetation.

Todites Williamsoni is referred on good grounds to the Osmundaceæ, while species of the genus *Coniopteris* approach wonderfully closely, in the characters both of the sterile and fertile pinnæ, to the recent Cyatheaceous genus *Thyrsopteris*, of which a single species survives in the island of Juan Fernandez.

The genus *Dictyophyllum* is placed, with *Protorhipis*, in the Dipteridinæ, which the author regards as distinct from the typical Polypodiaceæ, while *Klukia* and *Ruffordia* represent the Schizæaceæ. The presence of true Polypodiaceæ is more doubtful, though several genera, including *Sagenopteris*, often regarded as a Marsiliaceous plant, are provisionally referred to this family.

Among the numerous remains showing Cycadean affinities, two genera, *Williamsonia* and *Anomozamites*, are placed in the family Bennettiteæ, a remarkable group, with flowers far more complex than those of the true Cycads, the characters of which have been revealed to us by the investigations of Carruthers, Solms-Laubach, Lignier, and others, on petrified specimens. Mr. Seward showed, in his Wealden Catalogue, how close is the affinity between *Williamsonia* and *Bennettites*, and, indeed, treated the former as a subgenus of the latter; in the present volume, however, the generic rank of *Williamsonia* is again recognized. Mr. Seward has also previously shown that the leaves of the old '*Zamia gigas*' really belonged to the same plant as the *Williamsonia* flowers, and has thus completely confirmed Williamson's original restoration of the plant.

The genus *Anomozamites*, characterized by the almost entire or imperfectly segmented leaves, is referred to Bennettiteæ on the evidence of specimens described by Nathorst from the Rhætic of

Sweden, in which the characteristic foliage is borne on the same stem with *Williamsonia*-like fructifications. The habit, however, as shown in Nathorst's restoration, with a slender, repeatedly forked stem, is totally different from anything known among the Bennettiteæ or other Cycadales.

The genus *Ctenis* is one of those which has oscillated, in palæobotanical works, between the Ferns and the Cycads. The author has succeeded in observing the microscopic structure of the epidermis, and has proved that the supposed sori, held to indicate Filicinean affinities, are not really of a reproductive nature, but represent mere elevations of the epidermal cell-walls.

The account of the Ginkgoales, now solely represented by the Maidenhair-tree, itself almost extinct in a wild state, is particularly interesting. The evidence for the great antiquity of this group, once more critically examined by the author, appears to be quite conclusive. The remarkable seed-bearing fructification, named *Beania gracilis* by Carruthers, and usually regarded as a Cycadean strobilus, is considered by Mr. Seward to belong more probably to the Ginkgoaceæ. In the course of his argument on this question, the author makes the striking statement that "we have no satisfactory instance of a female Cycadean flower of Mesozoic age which can be reasonably connected with a plant bearing Cycadean foliage" (p. 274). In other words he considers that all the evidence indicates the Bennettiteæ, and not the true Cycadaceæ, as the family to which Mesozoic Cycadales belonged, while other authorities have always admitted the co-existence of the two groups in Mesozoic ages.

Several Coniferæ are described, the most striking, perhaps, being *Pagiophyllum Williamsoni*, with fairly well preserved cones *in sitû*. With the exception of some Araucarian cone-scales, none of the Coniferous remains can be referred with any certainty to a special family.

In his concluding remarks the author lays stress on the close agreement between the European Jurassic flora and the Gondwana flora of India and Australia. "In Jurassic times there was no doubt a much greater uniformity in the vegetation of the world than exists at the present day" (p. 306). Attention is also called to the great similarity between the Lower Oolitic and the much later Wealden flora, a similarity which in a few cases even appears to amount to specific identity.

Mr. Seward's new volume will be recognized as one of the most sound and valuable contributions to Palæobotanical Taxonomy.

D.-H. S.

II.—Jurassic Fauna of Cutch: The Brachiopoda. By F. L. Kitchin, M.A., Ph.D. (Memoirs of the Geological Survey of India, 1900, ser. ix, vol. iii, pt. 1, pls. i–xv, pp. 1–87.)

THIS is a painstaking and very critical work, which deserves every commendation. The author has fully realized the responsibility of the task, and he strikes the right note in his

introduction (p. 4). He says in regard to cases of resemblance to European forms: "It has been considered more expedient to apply a new 'specific' name than to ascribe the doubtful form as a 'variety' to the respective European 'species.' This has been done in the belief that the application of the term 'variety' is not admissible in cases where the direct relationship to the 'species' either cannot be definitely proved or at least does not appear very highly probable, for it surely commits us to the opinion that such relationship exists, whereas the use of a 'specific' name, while fulfilling the requirements of convenience, leaves the question of relationship open."

This is evidently the correct course. For it must be confessed that among our English Jurassic Brachiopoda, as well as among other fossils, too few names have been far more hindrance to our knowledge than too many. Especially regrettable has been the placing by study geologists as 'varieties' of well-known 'species' forms which lived long before those species, a course taken against the express wishes of the field geologists, but taken to satisfy the lumping tendency so prevalent in the middle of last century. Anyone can lump, but to lump correctly is the difficulty—that is a paraphrase of the words of a German palæontologist. And now it may be said in dealing with similar forms—where there is any marked difference of horizon or locality what has to be proved is the combination, not the separation. The former is the rash course, and it must be justified by very clear evidence; the latter is the course which experience has so frequently proved to be correct, and therefore its adoption is justified by analogy.

It is the latter course that Dr. Kitchin has rightly followed. He has found among these Jurassic Brachiopods of Cutch many forms with striking resemblances to European species; but the chronological difference is great, and so is the difference of locality. Remarking on the fauna as a whole the author says, "it would thus appear that the Middle Jurassic Brachiopoda are less adapted to serve as indices to the detailed stratigraphical comparison of remotely separated areas than the Cephalopoda" (p. 79). This is, of course, what would be expected, though remoteness is not always a necessary factor. There is the remarkable case in our English Jurassic Brachiopoda fauna, the notable discrepancy for a portion of Inferior Oolite time of the Cotteswold species from those of Somerset–Dorset, and even from those of Dundry, only a few miles away; whereas both before and after this time the same species of Brachiopoda are found in all these districts, and even from Gloucestershire to Würtemberg the Brachiopods are good indices for detailed stratigraphical comparison.

The resemblance, which the author notices, of later Cutch species to European forms earlier in date need not destroy the value of the Brachiopods for stratigraphical work, though it may make direct comparison difficult. But the same thing is known in Europe. Many examples might be cited, but sufficient will be *Zeilleria Mariæ* of the Middle Lias, *Zeilleria bullata* of the Fuller's Earth, *Zeilleria perobovata* of the Cornbrash; or *Terebratula submaxillata*

of the Inferior Oolite and *T. maxillata* of the Great Oolite. Such cases, though unsatisfactory from the stratigraphical standpoint, are of great biological interest; they indicate the independent development of similar forms at successive dates. So the similarity which the author has noticed in the Indian species to earlier European forms probably illustrates the same law.

This, however, suggests a query. The author remarks that his *Terebratula euryptycha* persists throughout the series of strata he describes. But has he not put into one 'species' too many varied forms? Are not these forms independent uniplicate developments—the intermediates between non-plicate and biplicate forms? Such is the case with the European fauna; non-plicate, uniplicate, biplicate mark three stages in serial development, and such development is repeated at different dates.

In drawing to a close this notice of a most interesting work it is advisable to call the author's attention to one unfortunate oversight: the references in the explanations of the plates do not correspond with the pages of the text. S. S. B.

REPORTS AND PROCEEDINGS.

Geological Society of London.

I.—A special general meeting was held on Wednesday, March 27, 1901, at 8 p.m., the President in the chair, on the requisition of the following five or more Fellows, namely: The Rev. J. F. Blake, Dr. Henry Woodward, Dr. A. Smith Woodward, Sir Henry H. Howorth, Dr. F. A. Bather, Mr. R. Bullen Newton, Mr. H. A. Allen, Mr. C. Davies Sherborn, Dr. F. L. Kitchin, Mr. Upfield Green, and Mr. G. E. Dibley; for the purpose of considering the following matters:—

1. The present state of the Society's Museum.
2. The steps necessary to be taken for putting the collections therein contained into a satisfactory condition, if retained in the Museum; or otherwise the desirability and conditions of their disposal elsewhere, as may be decided on.
3. The arrangements necessary to be made, in order to keep the collections constantly in a satisfactory condition, if their retention is decided on.
4. The amount necessary to be expended (*a*) in the first instance, and (*b*) annually, to carry out the decisions of the Meeting. Also to authorize the Council to incur this expenditure; and finally, to make such order concerning the estates or revenues of the Society as to the Fellows assembled in such General Meeting shall appear useful for the purpose of carrying out their decisions.

The Rev. J. F. Blake proposed and Mr. R. Bullen Newton seconded the following resolutions:—

1. That the general collection in the Society's Museum be limited to such specimens as have been or may hereafter be definitely referred to, by name, description, or figure, in the Society's publications, or in such other works as may be agreed upon by the Council.
2. That the specimens retained be thoroughly cleaned, provided with fresh labels additional to the old ones, placed in drawers or boxes designed to exclude dust, and arranged with reference to the papers or works wherein they are referred to, and that a catalogue of such retained specimens be printed.

3. That the remaining specimens be disposed of in such a way as the Council may direct.
4. That the Council be authorized to expend, either out of capital or income, so much as may be necessary to carry these resolutions into effect.

The following amendment was moved by Sir Henry Howorth, F.R.S., and seconded by Professor W. Boyd Dawkins, F.R.S. :—

That in the opinion of this Meeting the time has now come when this Society shall transfer its collections to some other museum.

The amendment was put, and there voted for it 22, against 19.

The amendment was therefore carried, and on being again put as a substantive resolution there voted for it 26, against 19.

The amendment was therefore declared carried as the resolution of the meeting.

II.—April 3rd, 1901.—Horace W. Monckton, Esq., F.L.S., Vice-President, in the Chair.

The following communication was read :—

"The Igneous Rocks and Associated Sedimentary Beds of the Tortworth Inlier." By Professor Conwy Lloyd Morgan, F.R.S., F.G.S., and Sidney Hugh Reynolds, Esq., M.A., F.G.S.

It has long been known that igneous rocks occur in the district under consideration, but opinions are divided as to their intrusive or contemporaneous character. Evidence is here brought forward to show that the igneous rocks form two bands, the lower interbedded with Upper Llandovery strata and the upper overlain by Wenlock, and that both bands are probably contemporaneous lavas.

The igneous rocks appear at two horizons, both in the Charfield Green district and also in the district which includes Avening Green, Damery, Micklewood, Daniel's Wood, etc. At Charfield their general run is north-north-west and south-south-east, and the upper band is associated with a bed of calcareous ash. The ash contains lapilli, felspar-crystals, quartz-grains, small shaly patches, and fossils, cemented by calcareous matter. The fossils, determined by Mr. Cowper Reed, probably indicate the Wenlock age of the rock. The associated trap would thus seem to be interbedded—a conclusion strengthened by its uneven surface and highly amygdaloidal character.

At Daniel's Wood the higher bed of trap is overlain by limestones which contain Wenlock fossils, and underlain by rocks with Upper Llandovery fossils. The dip of the rocks appears to indicate the existence of an anticline. The rocks underlying the trap-band of Damery Quarry are not seen, but above the trap are rocks bearing Upper Llandovery fossils. This trap occupies a large area near Woodford Farm. The same band of trap at Middle Hill underlies an ash-bed in which fossils of Upper Llandovery age have been found. The rocks, as a whole, follow the north-eastern and northern boundaries of the Bristol Coalfield.

The microscopic examination of the lower igneous rock shows that it is a basaltic andesite containing plagioclase (acid andesine or oligoclase), pseudomorphs after enstatite, with chloritic and iron-oxide patches. The higher bed sometimes contains fresh augite, and both bands frequently contain rounded grains of quartz. In other examples the felspars appear in three forms, with augite and enstatite, and the rock ranges from an andesite to a porphyritic basalt. The quartz-grains present appear to be xenoliths. The silica-percentage of the rocks on a moisture-free basis varies from 61 to 67, while the specific gravities are from 2·74 to 2·99.

III.—April 24th, 1901.—J. J. H. Teall, Esq., M.A., V.P.R.S., President, in the Chair.

The Secretary read the following letter, which had been received from H.M. Secretary of State for the Home Department:—

Home Office, Whitehall, 3rd April, 1901.

Sir,—

I am commanded by the King to convey to you hereby His Majesty's thanks for the Loyal and Dutiful Address of the President, Council, and Fellows of the Geological Society of London expressing sympathy on the occasion of the lamented death of Her late Majesty Queen Victoria, and congratulation on His Majesty's Accession to the Throne.

I am, Sir,
Your obedient Servant,
Chas. T. Ritchie.

J. J. H. Teall, Esq.,
Geological Society of London,
Burlington House, W.

The President drew attention to a framed and glazed copy of the Table of the British Strata by Dr. Henry Woodward, F.R.S., F.G.S., and Horace B. Woodward, Esq., F.R.S., F.G.S., which the authors had kindly presented to the Society.

In exhibiting a specimen of *Crioceras occultus* from the Snettisham Clay of Heacham, near Hunstanton, Professor H. G. Seeley said that he had no doubt that the *Trigonia hunstantonensis* and *Crioceras occultus*, originally described as from the Hunstanton Limestone, were from the clay at Heacham. The example of *Crioceras* now shown was found by Mr. F. Deighton, of Cambridge. It differs only as a variety from the type figured in 1865.

The following communications were read:—

1. "Notes on two Well-Sections." By the Rev. R. Ashington Bullen, B.A., F.L.S., F.G.S.

The well-section at Southwark passes through sand and gravel, etc., 34 feet, London Clay 75 feet, Woolwich and Reading Beds 56 ft. 9 ins., and Thanet Sand 36 ft. 6 ins., into Chalk which was bored to a depth of 148 feet.

The well-section at Dallinghoo Post-Office, near Wickham Market (Suffolk), penetrated 53 feet of blue Chalky Boulder-clay, into 20 feet of sand and gravel, water being found at a depth of 79 feet. Liassic and Oxford Clay fossils were found in the Boulder-clay and

stones, one of which is considered by Professor T. Rupert Jones to have probably come from the Carboniferous rocks and one from the Bunter. The Sands contain no Crag fossils. Mr. F. Chapman, A.L.S., determined fossils from some of the boulders, from fragments of stone found in the Sands, and from the Sands themselves. The last consist of Cretaceous Foraminifera.

2. "On the Geological and Physical Development of Antigua." By Professor J. W. Spencer, Ph.D., M.A., F.G.S.

Antigua and Barbuda rise from the bank which occupies the north-eastern portion of the chain of the Lesser Antilles. The part of the bank on which these two islands are founded is submerged to the very uniform depth of about 100 feet, but from other island-groups it is separated by depressions of 1,800 to 2,500 feet. The margins of the bank are abrupt and precipitous, and are indented by deep valleys extending to the more profound depressions. The igneous basement-rocks of the island form the south-western mountain-belt. They are porphyritic andesites or porphyrites, with breccias and ashes which dip north-eastward. Associated with these rocks, and probably overlying them, are limestones which have not yet yielded fossils. The second and median belt of the island consists of stratified tuffs, which included marine and fresh-water cherts. From the evidence of fossils these rocks may be Upper Eocene or Lower Miocene, and they manifestly are closely related to the rocks which follow them. The succeeding formation consists of earthy marls associated with beds of white limestone, and is apparently conformable to the underlying tuffs. A list of fossils is given, from which it is concluded that the beds are of Upper Oligocene age. Next follows a creamy-white, calcareous sandstone, and then the Friar's Hill Series of conglomerates and marls, resting unconformably on the white limestones, and considered to be of late Pliocene or early Pleistocene age. These are succeeded by the Cassada Garden Gravels, recent marls containing land-shells some of which are extinct, and coral reefs, none of which are raised.

An account of the erosion features of the region is given, and from this the following conclusions are drawn:—The region was an extensive land-surface, probably at least 2,000 feet higher than now, during the Mio-Pliocene period, and was reduced by denudation to a comparatively low elevation before the close of that time. This was followed by a submergence (the Friar's Hill) to a depth of 200 feet below the present altitude. At the close of the Pliocene period there was another elevation to an extent probably exceeding 3,000 feet, as shown by the channels on the submarine plateau between Antigua and Guadeloupe. This did not continue sufficiently long to complete the dissection of the tablelands. and consequently the Antigua-Barbuda mass remains intact. Then followed a subsidence culminating in a 75-foot submergence, a re-elevation to 100 feet above the present level, when the shallow channels in the submarine bank were formed, and possibly one or two other small movements.

3. "On the Geological and Physical Development of Guadeloupe." By Professor J. W. Spencer, Ph.D., M.A., F.G.S.

The Guadeloupe group is separated from the Antigua and Dominica groups by depressions 2,000 feet deep. Much of Guadeloupe itself consists of eruptive rocks, evidently as old as the igneous base of Antigua. The lowest beds of Grande Terre are yellow tufa, surmounted by 75 or 80 feet of volcanic sand of early Tertiary age. A calcareous formation conformably follows, dipping north-eastward. These two formations seem to correspond with the Oligocene rocks of Antigua. The Lafonde Gravel and Marl succeeds them unconformably, and it is possible that the limestone of the Usine of Pointe à Pitre is of about the same general age. In addition to these formations there are raised coral-reefs, consolidated calcareous sands, alluvia, the loams and gravels of the Petit Bourg Series, and various fragments of calcareous groups. The tooth of a small *Elephas*, allied to the Maltese type, and found in Grande Terre, is mentioned.

The land-surface during the Mio-Pliocene period appears to have been 2,000 feet above the present level, but it was submerged 200 feet at the close of the Pliocene period during the accumulation of the Lafonde and Lower Petit Bourg gravels and loams. There was a re-elevation of about 3,000 feet in the early Pleistocene period, and during this epoch *Elephas* could have crossed from the continent. This was followed by a depression to 100 feet or more below the present level, a re-elevation to 150 feet, submergence below the present level with growth of corals, and the elevation of these to 6 or 8 feet above the sea.

4. "On the Geological and Physical Development of Anguilla, St. Martin, St. Bartholomew, and Sombrero." By Professor J. W. Spencer, Ph.D., M.A., F.G.S.

Deep channels, not less than 1,800 feet deep, separate the bank on which this group is founded from the banks to the north and south. The oldest rock of St. Martin and St. Bartholomew consists of greenstone or dioritic porphyry usually much decayed, followed by altered limestones, and volcanic ashes and breccias. The calcareous divisions are associated with chert and deposits of manganese. Fossils found in these rocks in St. Bartholomew determine the age as equivalent to the Middle Eocene of Europe. A white limestone formation, which appears to correspond with the limestone series of Antigua, follows unconformably. The limestone is partly phosphatized at the surface and is pitted by caverns. It is apparently succeeded by upper strata, with a modern fauna, similar to that of the Pointe à Pitre Limestone of Guadeloupe. The limestones are unconformably covered by mantles of breccia, gravels, and sand, which may be regarded as the equivalent of the Columbia formation of the American Continent. The St. Martin plateau was a land-surface throughout the Mio-Pliocene period, during the earlier part of which it appears to have stood 2,500 feet above its present level, and was probably connected with the now neighbouring insular

masses, from which it was disconnected by denudation during a very long period of atmospheric activity, followed by a subsidence, so as to bring the present surface of the submarine banks to a level so low that the undulating features of a base-level of erosion could be formed on them; for, during the period when the deep and broad depressions on the Antillean chain were being fashioned, the now isolated island-groups stood out as table-mountains, which were slowly being eaten away by atmospheric agents. There was next a subsidence to about 200 feet below the present level, about the close of the Pliocene period, followed by a re-elevation to 3,000 feet, as shown within the area, but in reality much more. It was during this early epoch of the Pleistocene that the great rodents described by Professor Cope reached here from South America, but the race continued to live here sufficiently long to give rise to distinct species. The submergence of the mid-Pleistocene period was to the extent of about 200 feet, and the subsequent elevation was marked by moderate denudation with the production of shallow watercourses, traceable across the sunken banks to depths of 150 or 180 feet. Again there was a moderate depression sufficient to bring the surface a few feet below the present level, succeeded by a rise during which the low shell-bearing sands were formed.

5. "On the Geological and Physical Development of the St. Christopher Chain and Saba Banks." By Professor J. W. Spencer, Ph.D., M.A., F.G.S.

The St. Christopher (St. Kitt's) ridge rises from 2,000 to 2,800 feet above the submarine Antillean plateau, and is for the most part covered with shallow water, except between St. Kitt's and Montserrat, where a depression reaches 2,592 feet, and between Statia (St. Eustacius) and Saba, where it reaches 1,200 feet. Relics of old igneous formations are found on the islands, but in most places they are covered by more recent volcanic formations.

The Brimstone Hill Limestone is the succeeding formation, which appears to be newer Pliocene or Pleistocene, and to correspond with the Upper Marls of Anguilla and those at the Usine of Pointe à Pitre in Guadeloupe.

The St. Kitt's Gravels succeed, and in beds of apparently the same age shells of living species have been found at an altitude of 300 feet. The main volcanic activity belonged to the mid-Pleistocene period. It is inferred that the group underwent the same physical history as the neighbouring groups of islands. First there was elevation, followed by subsidence. Then came the second great elevation to about 3,000 feet and erosion of the region, when the deep valleys and cirques indented the margins of the tablelands, and at the same time the great volcanic ridges were built. Next followed another subsidence to about 300 feet below the present level, and during this epoch the volcanic domes of Brimstone Hill and the 'Quill' of Statia were formed. The succeeding upward movement carried the land 60 feet or more above the present level, when ravines and small channels in the sunken shelf were excavated.

Another depression to 40 or 50 feet filled up these ravines. Then came final re-elevation, and it is possible that a downward movement is now in progress.

CORRESPONDENCE.

NAMES FOR BRITISH ICE-SHEETS.

Sir,—Although Professor Bonney does not, I believe, at present allow himself to be included among "glacialists who hold the 'land-ice theory,'" to whom my letter on the above subject (Geol. Mag., March, 1901, p. 142) was addressed, his comments (Geol. Mag., April, 1901, p. 187) are particularly welcome as he shows, by practical application of two of the terms, that the proposed nomenclature may have its advantages even to the opponents of the 'land-ice theory.' Granting that the former existence of ice-sheets in this country is a disputed inference, we may nevertheless find the suggested terminology convenient in the discussion, even when it is denied that the terms represent anything more than an ill-founded conviction. From Professor Bonney and those who think with him I ask no more than that the nomenclature of the British Ice-sheets be accepted on this basis.

By the way, I will seek Professor Bonney's permission to amend his simile; surely, in this case it is not that the glacialist is counting his birds before they are hatched, but after they are flown, by the indications in the roost.

In his playful suggestion of 'Dogger-fjeld' as a name for the 'East British Ice,' and in his accompanying argument as to the direction of ice-flow, Professor Bonney seems to have taken for granted that the Dogger Bank was a *pre-glacial* feature. But there is much reason to believe that this Bank is of *glacial* origin, while of the *pre-glacial* contours of the floor of the North Sea we know nothing. In areas of low relief the radial point of ice-flow must depend principally upon the incidence of maximum snowfall, and under changing conditions of climate may not remain fixed in the same place. I have elsewhere set forth facts indicating that the East British Ice underwent great changes in this respect during the progress of the Glacial Period.

The issue raised by Professor Bonney as to the transport of the Scandinavian boulders to our eastern coast has been frequently discussed in my writings on the Yorkshire drifts; and it seems almost superfluous to reiterate my opinion that the presence of these boulders does not imply their direct transport across the North Sea basin by land-ice. I was convinced by my prolonged examination of the Basement Clay of East Yorkshire that the invading ice-sheet had ploughed up a sea-bottom already strewn with boulders from the shores,—"wherefrom it follows that we must not place much confidence in the evidence gleaned from its erratics as to the actual direction and distance which the ice-sheet has traversed."

By another friendly critic a well-grounded objection has been raised to the proposed term 'Cambrian Ice-sheet,' on account of the risk of confusion with the common stratigraphical use of 'Cambrian.' It would, perhaps, be safer to fall back upon the phrase 'Welsh Ice-sheet' (with subdivision into 'North Welsh' and 'South Welsh' if found desirable).

As previously stated, my more immediate object is especially to urge the adoption of names for the (hypothetical?) ice-sheets of our sea-basins, for which I have recently felt the pressing necessity. On the terms proposed for the land-areas I do not at present lay much stress, though it would be convenient if these could be fixed at the same time.

G. W. Lamplugh.

Tonbridge.
April 6, 1901.

THE SODIUM OF THE SEA.

Sir,—I am extremely obliged to Mr. Fisher for his kindly notice of my communication concerning the "Sodium of the Sea," but feel at a loss how to reply, owing to uncertainty as to whether Mr. Fisher has considered and rejected De la Beche's articles on Granite and Elvan, Divisional Planes, and Mineral Veins and Faults; or, has possibly overlooked such an ancient authority.

In addition to all that De la Beche and Dr. Sorby have written, and since the last edition of the "Physics of the Earth's Crust," we have the additional fact that all the types of fluid inclusions found in granites may be matched in different quartz-veins, so that all the arguments based on the fluid inclusions in igneous magmas must be prepared to meet the cases of the veins. My object in writing was not so much to defend the sea-water hypothesis, as to remind geologists that it existed. Throughout my own early training I was never allowed to forget that the weakest link in a chain is the measure of its strength, and I knew full well that the slightest slip in fact or argument involved public castigation in the Transactions of the Devonshire Association. If any of the younger geologists in Devonshire erred in discipline our captain, William Pengelly, rarely failed to pipe all hands on deck to witness punishment. Mr. Fisher, I expect, will agree with me that in the present day it is considered of far more consequence that a theory should present a solid appearance than that each link should be tested, and if defective, rejected, not only by the purchaser but by the chainmaker himself.

A. R. Hunt.

Foxworthy, Moretonhampstead.
May 7, 1901.

INTERNATIONAL GEOLOGICAL CONGRESS.

Sir,—I regret that I omitted to express my thanks in my paper, "Geological Notes on Central France," published in the Geological Magazine (February, 1901, p. 59), to the Directors, MM. Boule, Fabre, and Martel, for their kindness and consideration during the

Congress excursion to that region. I did not intend the notes as a narrative of the excursion, only as a small help to friends interested in geology who may not possess that most admirable guide, the "Livret Guide," provided by the Committee for members of the International Geological Congress, over which so much labour must have been expended.

I desire now through the medium of the GEOLOGICAL MAGAZINE to tender my sincere thanks to the Directors, to whom we were all greatly indebted for their kind attention and able discourses.

M. S. JOHNSTON.

HAZELWOOD, WIMBLEDON HILL.
April 24, 1901.

THE FISH FAUNA OF THE MILLSTONE GRITS.

SIR,—May I point out to Dr. Wellburn that the value of his work on Palæozoology will be enhanced if he will take a little more trouble in his method. I read *Psephodus*, sp. nov., *Acanthodes*, sp. nov., *Eucteuodopsis*, sp. nov.; but in all these cases I have to dig the specific names out of the text. They should follow the generic name; if they do not they are likely to be overlooked. Those forms which are described, and to which specific names are given by the author, should also have been properly entered up in the table. The specialist will, no doubt, read such papers right through, but that will certainly not be the case of the

OVERWHELMED RECORDER.

OBITUARY.

EDWARD CRANE, F.G.S.

BORN NOVEMBER 22, 1822. DIED APRIL 25, 1901.

EDWARD CRANE, youngest son of Wright Edward Crane, Esq., landowner, of Thorney, Cambridgeshire, and Mary, his wife, was born November 22nd, 1822. He was educated at Wisbech Grammar School, spent two years fishing and shooting in Ireland, and before he was of age had settled down to the pursuit of agriculture as a tenant farmer on the Duke of Bedford's model Thorney estate. In 1851 he married Jane Turnell, eldest child of a neighbouring farmer, and remained in Thorney until 1866, when he retired and went to live at first in the vicinity of the Crystal Palace. Soon afterwards, accompanied by his wife and daughter, he visited the continent of Europe, and, returning to England in November, 1867, settled in Brighton; having purchased a house in Wellington Road, he resided there until his sudden death on April 25th, 1901.

When the town Museum was removed from the Pavilion rooms to the present building in Church Street, Edward Crane assisted in arranging the geological gallery. He became a member of the Museum Sub-Committee in 1873 during the Chairmanship of his

old friend Dr. Thomas Davidson, F.R.S. On the death of the latter in 1885 he was elected Chairman of the Committee, in which capacity he served the interests of science in the town of Brighton very faithfully for eight years. Increasing age and deafness led him to resign the Chair, but he was annually re-elected a member of the Committee, and although rarely attending the meetings, continued to be actively interested in the Museum, and assisted the curators in every way. Edward Crane published in the Brighton Public Museum Report for the years 1891–92 (Brighton, 1892) a "List of the Type Specimens in the Brighton Museum." He was elected a Fellow of the Geological Society of London in 1872, and frequently attended the meetings in London until his age and deafness denied him the pleasure. He was an enthusiastic visitor at the Natural History Museum, and also visited the principal museums of Central Europe and Scandinavia. In 1881, accompanied by his daughter, he made an extended tour in the Eastern and Western United States and Canada, and in the Winter of 1884–5 visited Spain, Cuba, Mexico, and the Southern United States. He had formed warm friendships with scientists of that great country, which he dearly loved. Edward Crane remained deeply interested in scientific literature up to the last, and was keenly enjoying Macnamara's "Origin and Character of the British People," and his dear friend Mrs. Zelia Nuttall's "Fundamental Principles of Old and New World Civilizations," during the last week of his life. Edward Crane passed suddenly away from heart disease of long standing at St. John's Lodge, Wellington Road, Brighton, on April 25th, 1901, and was cremated and interred on April 30th at Woking, Surrey (No. 458, facing north-west), by his written directions. His widow, Jane Crane, survives him, and he leaves issue an only daughter, Agnes Crane, who has been a frequent contributor to the pages of the Geological Magazine and other periodicals.

MISCELLANEOUS.

Complimentary Dinner to Sir Archibald Geikie, D.C.L., F.R.S., etc.—Sir Archibald Geikie, who retired from the position of Director-General of the Geological Survey on February 28th, after forty-six years of public service, was entertained on May 1st at a complimentary dinner held at the Criterion, Piccadilly Circus. The Right Hon. Lord Avebury took the chair, and among those present were Major-General Sir John Donnelly, Sir George Stokes, Sir John Evans, Sir Frederick Abel, Sir Norman Lockyer, Sir Henry Craik, Sir William Turner, Sir Michael Foster, Sir Henry E. Roscoe, Sir Lauder Brunton, Sir Henry Howorth, Sir John Murray, Admiral Sir William Wharton, Major-General Festing, Prof. E. Ray Lankester, Mr. S. E. Spring-Rice, Prof. T. Mc K. Hughes, Mr. Digby Piggott, Colonel Johnston, Prof. Bonney, Prof. Lapworth, Prof. Watts, Prof. J. Geikie, Prof. Wiltshire, Prof. Hull, Dr. W. T. Blanford, Lieut.-General McMahon, Dr. Horace T. Brown, Major Craigie,

Dr. H. F. Parsons, Dr. J. S. Keltie, Prof. Galloway, Mr. Hudleston, Dr. P. L. Sclater, Prof. Joly, Prof. Garwood, Mr. Marr, Prof. C. Le Neve Foster, Mr. Whitaker, Prof. Sollas, Mr. Bauerman, Prof. G. A. J. Cole, Prof. Corfield, Mr. Monckton, Mr. Herries, Mr. G. Griffith, Mr. Teall, Mr. Horace B. Woodward, Mr. F. W. Rudler, and other members of the staff of the Geological Survey and Museum of Practical Geology, Mr. G. Murray, Dr. H. R. Mill, etc. Lord Avebury gave an interesting account of the scientific career of the guest, and Sir Archibald Geikie made an eloquent reply.

On the menu-cards was printed the coat of arms of "The Royal Hammerers," designed by the late William Hellier Baily in 1849, which we are enabled to reproduce here.

International Geological Congress, Paris, 1900: An Apology.—In printing "Notes on the Geology of the Eastern Desert of Egypt," by T. Barron, A.R.C.S., F.G.S., etc., and W. F. Hume, D.Sc., A.R.S.M., etc., published in the April number of this Magazine (pp. 154–161), the words "Abstract of a paper read before the International Geological Congress, Paris, August, 1900," were, by accident, omitted to be printed as a footnote to the title, for which the Editor offers his sincere apologies.

Death of Professor Gustav Lindström, For. Mem. Geol. Soc. Lond.—In a letter dated 20th May, 1901, addressed to Dr. F. A. Bather, of the Geological Department, British Museum (Natural History), Dr. E. W. Dahlgren, Librarian of the Swedish Academy of Science, Stockholm, writes:—"I have the painful duty to inform you of the decease of our common friend, Prof. Gustav Lindström, on the 16th inst. He had been suffering from erysipelas in the face, but his doctor said it was not dangerous, and no anxiety was felt about him. On the evening of the 15th, however, he became suddenly worse, and early next day he expired." Dr. Lindström was so closely associated with English palæontologists, and was in such intimate relations with geologists in every country, that his loss will be keenly felt by a wide circle of attached friends. We hope to give a suitable notice of Dr. Lindström's life and work in the July number of the Geological Magazine.—H. W.

May 25, 1901.